

Trouble-shooting instructions : SAA-5000
BOSCH system : K - Jetronic
Vehicle make : SAAB
Basic microcard : PKW - 033

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SPECIAL FEATURES

These instructions contain the K-Jetronic trouble-shooting instructions for the following SAAB models valid at the time of writing:

SAAB 900 Injection CAT 05.85->
2.0 ltr. / 4-cyl. engine

- * Lambda closed-loop control and catalytic converter
- * Fuel enrichment using pressure-surge switch and start valve at temperatures below 25°C
- * Fuel enrichment using pressure-surge switch and timing valve of the lambda closed-loop control at temperatures below 25°C (up to a max. of 2 minutes after each start)
- * Overrun cut-off (on vehicles with manual transmission)
- * In-tank electric fuel pump
- * In-tank pre-supply pump

Important: When referring to a basic microcard, note that the test specifications must always be taken from the vehicle-specific brief instructions.

SAFETY AND PRECAUTIONARY MEASURES

Always observe safety and precautionary measures in order to avoid hazards to persons and damage to the engine, the trigger box and control unit, and the ignition system.

CAUTION!

High-performance ignition system with dangerous high and low voltages!

Contact with voltage-carrying parts or terminals can be fatal (on both primary and secondary sides).

TROUBLE-SHOOTING CHART

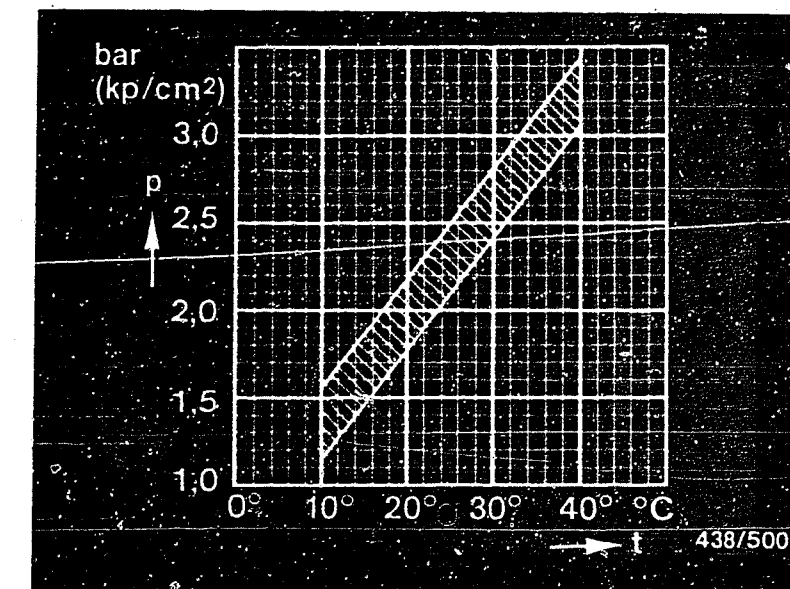
Customer complaint (symptoms of trouble)

1. Starting motor operates, engine fails to start or starts only with difficulty.
2. Engine starts but then dies.
3. Idle problems (engine speed, exhaust).
4. Poor throttle response.
5. Engine missing (ignition, fuel injection).
6. Insufficient engine power/top speed.
7. Excessive fuel consumption.
8. Engine diesels.
9. Engine pings / knocks.
10. Engine gets too hot.
11. Fault lamp.

| | | | | | | | | Cause (component fault) |
|---|---|---|---|---|---|---|---|------------------------------------|
| * | * | | | * | | | | Electric fuel pump |
| * | | * | * | | * | | | Induction system |
| * | | | | | | | | Fuel system |
| * | | * | * | * | * | | * | Fuel distributor |
| * | | * | * | * | * | | * | Air-flow sensor |
| * | | * | | | | * | * | Cold-starting system |
| * | | * | | * | | | * | Fuel-injection valves |
| | * | | | * | * | | | System pressure |
| * | * | * | * | * | * | * | | Control pressure |
| * | | * | * | | * | | | Overall delivered-quantity scatter |
| | | | | * | | | | Throttle valve |
| * | | * | * | | * | * | * | Lambda closed-loop control |
| * | | * | | | | | | Auxiliary-air device |

TEST SPECIFICATIONS

| No. | Testing/Test condition | Set specification |
|-----|--|---|
| 1 | Electric fuel pump – fuel delivery: Supply voltage (under load): | at least 1500 cm ³ /min at least 11,5 V |
| 2 | Fuel delivery – control–pressure circuit: | 160...240 cm ³ /min |
| 3 | Fuel distributor – system pressure: Test specification: Setting: | 4,7...5,4 bar 4,9...5,1 bar |
| 4 | Control pressure: Take control pressure "cold" from the chart opposite corresponding to the ambient temperature measured. Control pressure "warm": | 3,4...3,8 bar |
| 5 | Leakage test – total system: Minimum pressure after 10 mins.: Minimum pressure after 20 mins.: | 2,5 bar 2,4 bar |
| 6 | Injection valves – opening pressure: Leakage test at not below 2,8 bar: No drop must fall within 25s. | 3,0...4,1 bar |



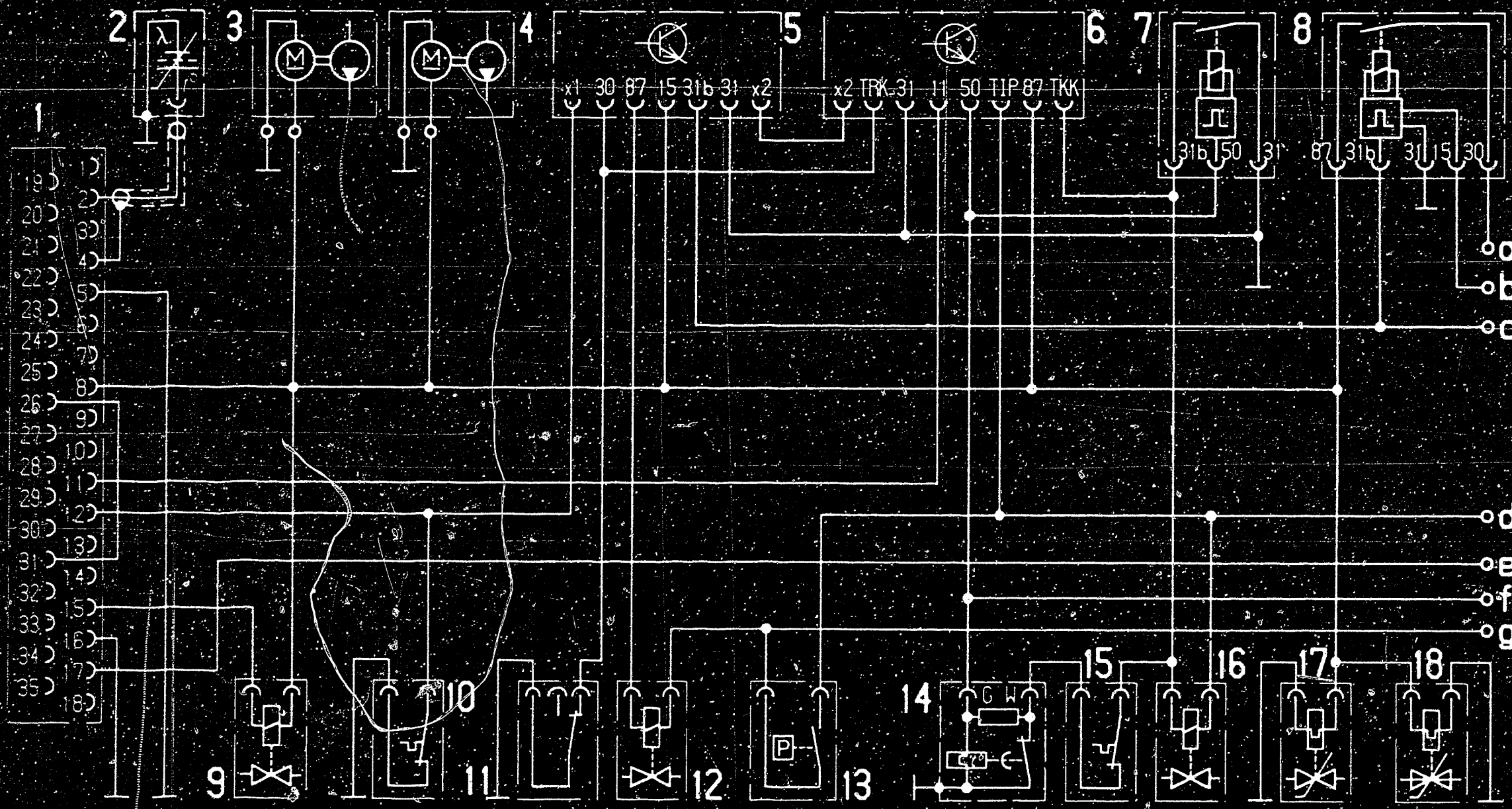
p = Contr. press. (overpress.)
t = Ambient temperature

TEST SPECIFICATIONS (CONTINUED)

| No. | Test/test conditions | Test specification | |
|-----|---|--|--|
| | | Setting point: (cm ³ /min) | max. perm. quantity: (cm ³ /min) |
| 7 | Comparative measurement of supply quantity: | | |
| | Idle : | 6,0 | 6,8 |
| | Part load: | 40,0 | 42,5 |
| | Full load: | 150,0 | 162,0 |
| | Minimum quantity at max. sensor plate deflection: | 162 cm ³ /min | |
| 8 | Thermo-time switch - resistance measurement: | below + 40° C | above + 50° C |
| | Terminal G and ground: | 30...40 Ω | 55...85 Ω |
| | Terminal W and ground: | 0 Ω | 120...160 Ω |
| | Terminal G and terminal W: | 30...40 Ω | 55...85 Ω |
| 9 | Idle setting* | | |
| | Idle speed: | 800...900 min ⁻¹ | |
| 10 | Lambda closed-loop control** | | |
| | Test conditions: | | |
| | Closed-loop control oscillating, mean value: | 45...55 % | |
| | t ₀ (lean stop): | max. 20 % | |
| | t ₁ (open-loop control): | 45...55 % | |
| | t ₂ (rich stop): | min. 85 % | |
| | t ₃ (warm-up enrichment): | 55...65 % | |
| | t ₄ (Acceleration enrichment, temperature > 25°C, up to max. 2 min. after each start): | 80...100 % | |
| | Timing valve, internal resistance at + 20°C: | 2...3 Ω | |

* Idle speed is adjusted with bypass screw on throttle-valve assembly

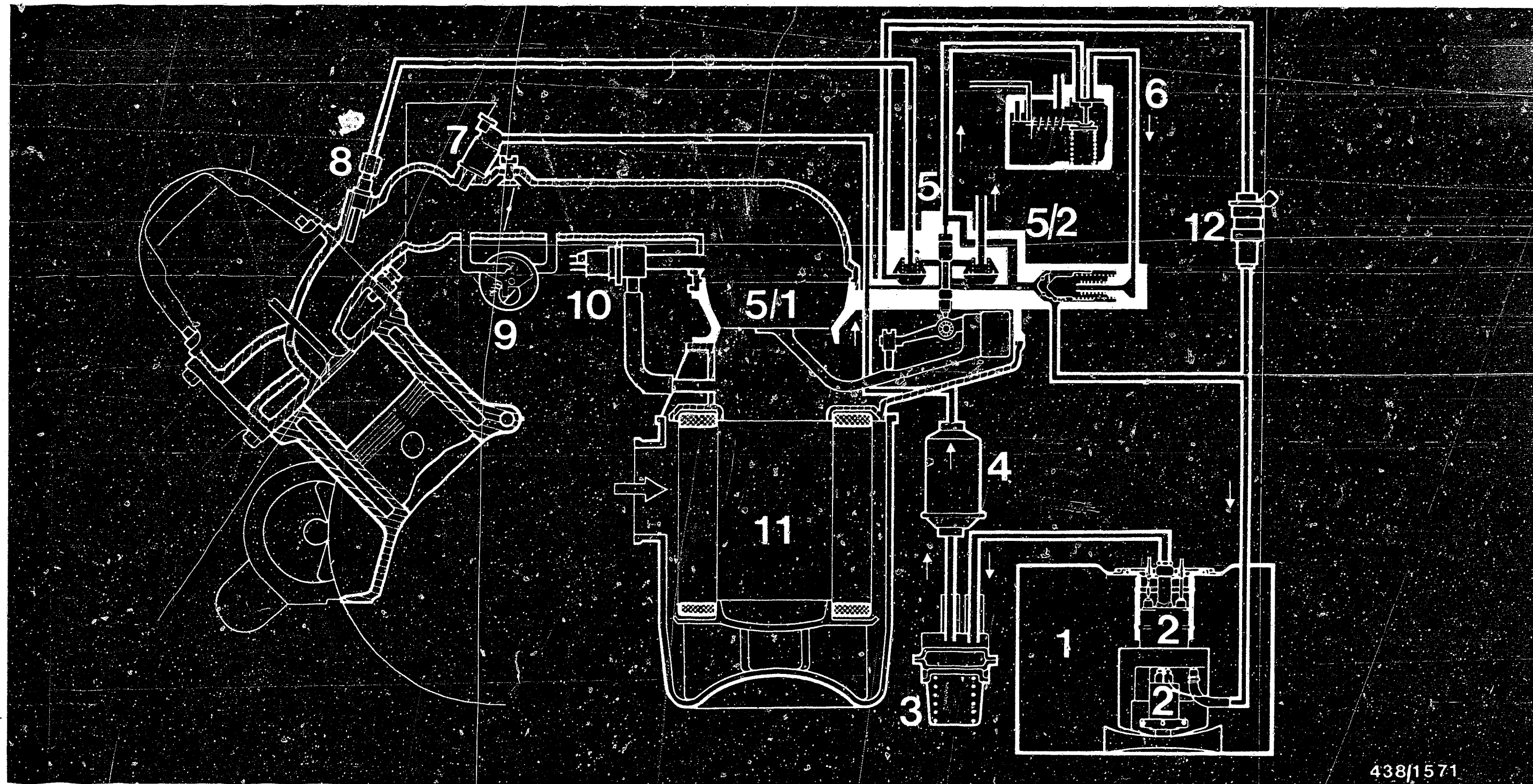
** Lambda closed-loop control is adjusted using the idle-mixture-adjusting screw.



438/1570

- | | | |
|------------------------------------|-------------------------------------|-------------------------|
| 1 = Contr. unit, lambda c-1 contr. | 10 = Temperature switch, +45°C | a = Terminal 30 |
| 2 = Lambda sensor | 11 = Throttle-valve switch | b = Terminal 15 |
| 3 = Electric fuel pump | 12 = Overrun cut-off sol.-op. valve | c = TD signal |
| 4 = Pre-supply pump | 13 = Pressure-surge switch | d = Terminal 16 |
| 5 = Engine-speed relay | 14 = Thermo-time switch | e = Lambda meas. output |
| 6 = Time-lag relay | 15 = Temperature switch, +25°C | f = Terminal 50 |
| 7 = Warm-start relay | 16 = Start valve | g = Terminal 54 |
| 8 = Fuel-pump relay | 17 = Warm-up regulator | |
| 9 = Timing valve | 18 = Auxiliary-air device | |

ELECTRICAL TERMINAL DIAGRAM WITH SAFETY CIRCUITRY FOR ELECTRIC FUEL PUMP



438/1571

- 1 = Fuel tank
- 2 = Electric fuel pump/pre-supply pump
- 3 = Fuel accumulator
- 4 = Fuel filter
- 5 = Mixture-control unit
- 5/1 = Air-flow sensor
- 5/2 = Fuel distributor

- 6 = Warm-up regulator
- 7 = Start valve
- 8 = Fuel-injection valve
- 9 = Auxiliary-air device
- 10 = Solenoid-op. valve for overrun cut-off
- 11 = Air filter
- 12 = Timing valve

AIR/FUEL LINE DIAGRAM

INSTALLATION POSITION OF COMPONENTS

- * Control unit for lambda closed-loop control:
On right beneath rear seat.
- * Timing valve:
In engine compartment where drive shaft passes through body.
- * Lambda sensor:
In engine compartment in exhaust manifold.
- * Lambda measurement output:
In engine compartment, 2-pin plug connection on left wheel well.
- * Fuel-pump relay:
In engine compartment in central electrics box on left wheel well.
- * Time-lag relay, warm-start relay:
In engine compartment at central lambda relay position on left wheel well.
- * +25°C temperature switch:
In engine compartment in intake manifold.
- * +45°C temperature switch, thermo-time switch, warm-up regulator, auxiliary-air device: In engine compartment, in thermostat housing at front of engine.
- * Start valve:
In engine compartment on throttle-valve assembly.
- * Pressure-surge switch:
In engine compartment on left wheel well beside fuel filter.
- * Solenoid-op. valve for overrun cut-off:
In engine compartment above air filter in rubber elbow.
- * Electric fuel pump, pre-supply pump:
In fuel tank beneath trunk floor.

For production reasons:
continued on the following
coordinate.

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BOSCH system : EI

Vehicle make : Seat

Basic microcard : OPE-513

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SPECIAL FEATURES

These trouble-shooting instructions apply to the following Seat models valid at the time of writing:

- * Ibiza 1.5 Injection, as of November 1986
- * Electronic ignition system with load-signal detection (EI).
- * Spark-advance unit 0 227 921 022 or. ..051
- * Trigger box 0 227 100 124 with current limiting

USAGE, STRUCTURE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble-shooting chart leads to various causes/ component faults.

Detailed instructions for trouble-shooting must be taken from the basic instructions via the trouble-shooting chart.

ATTENTION: Even if reference is made to basic instructions, the set values, terminal assignments and special features of these vehicle-related brief instructions are always binding.

SAFETY AND PRECAUTIONARY MEASURES

Keep persons out of danger.
Prevent damage to the engine, trigger box
or ignition system.

*** C A U T I O N !**

High-performance ignition system.
Dangerous primary and secondary voltages.

Touching voltage-carrying components or terminals may prove fatal (both on the primary and secondary sides).

* When testing the compression, disconnect the trigger-box plug or connect ignition coil term. 4 f i r m l y to ground using auxilliary cable.

NOTE:

Auxiliary cable must be interference-suppressed
with at least 2 k Ω .

See basic instructions for further precautionary measures.

TROUBLE-SHOOTING CHART

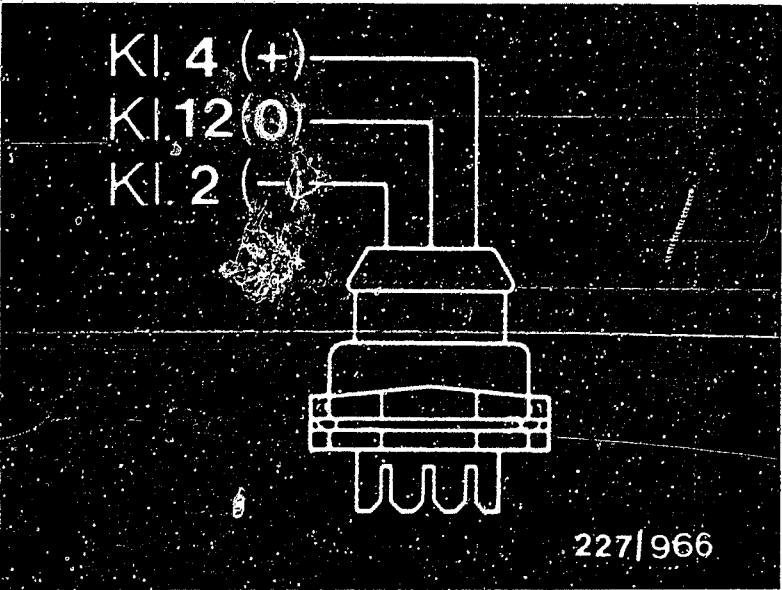
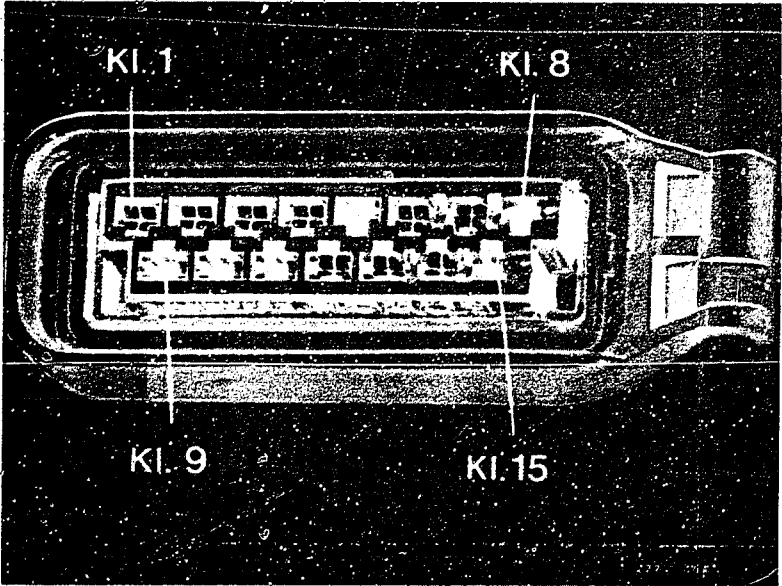
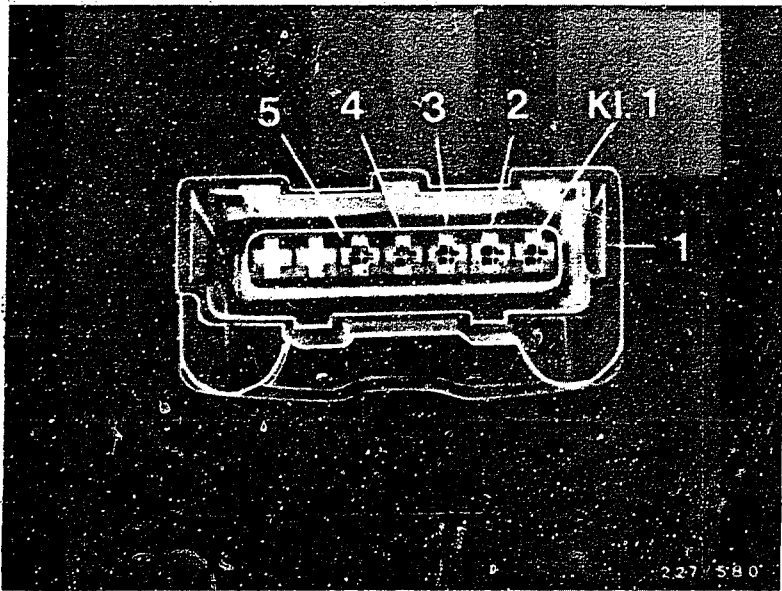
Customer complaint (symptoms of trouble)

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5. Engine missing (ignition, fuel injection).
6. Insufficient engine power/top speed.
7. Excessive fuel consumption.
8. Engine diesels.
9. Engine pings/knocks.
10. Engine gets too hot.
11. Fault lamp.

| | | | | | | | |
|---|---|---|---|---|---|-----|------------------------------------|
| | | | | | | | Cause (component defect) |
| * | * | * | * | * | * | | High-voltage side |
| * | * | * | * | * | | | Ignition coil |
| * | * | | | | | | Firing sequence |
| * | | | | | | | Voltage, trigger box |
| * | | | | | | | Voltage, primary circuit |
| * | | | | | | | Voltage, spark-advance unit |
| * | | * | * | | | | Voltage, magnetic pulse generator |
| * | | * | * | | | | Function, magnetic pulse generator |
| * | | | | | | | Function, spark-advance unit |
| * | | | | | | | Engine-speed signal |
| * | | | | | | | Ignition distributor |
| * | | | | | | | Contact resistances |
| | * | * | * | * | * | * * | Throttle-valve switch LL |
| | * | * | * | * | * | * * | Throttle-valve switch VL |
| | * | * | * | * | * | * * | Basic ignition setting |
| | | | * | * | | | Jetronic load signal |
| | | * | | | | | Voltage, spark-advance unit |
| | | * | | | | | Voltage, trigger box |
| | | * | | | | | Voltage, ignition coil |
| | | * | | | | | Primary voltage |

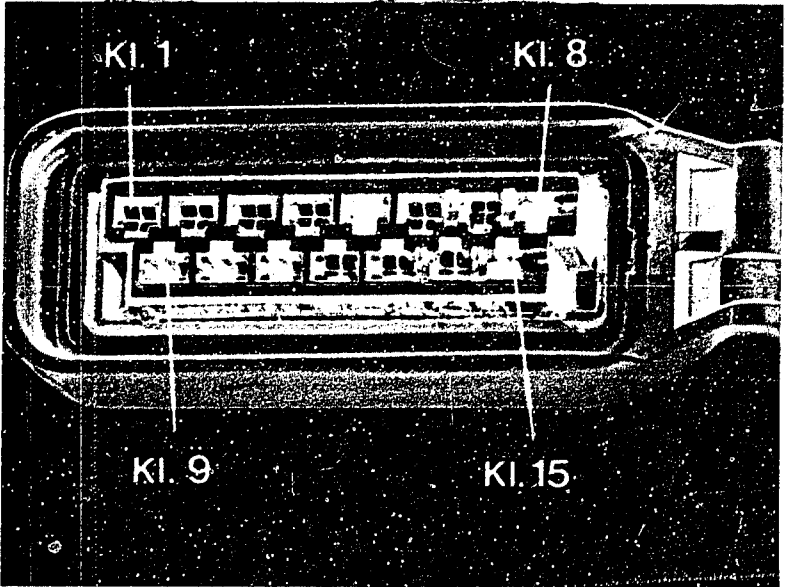
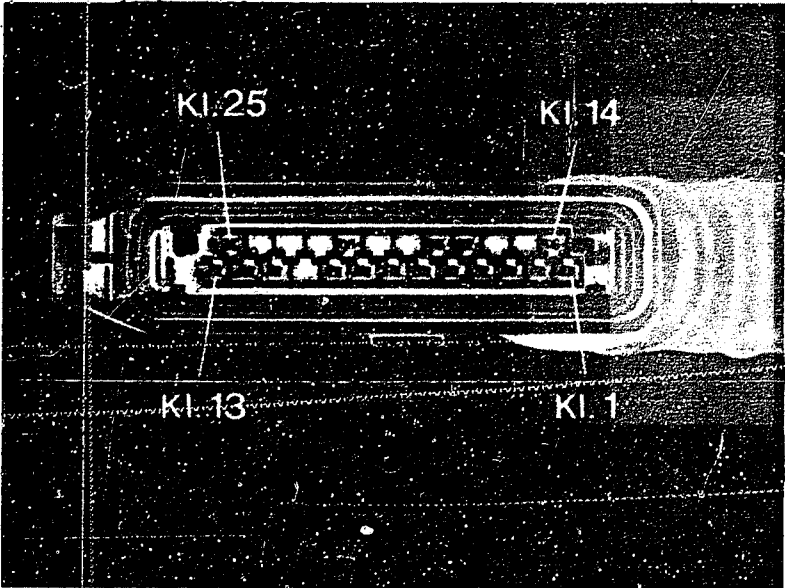
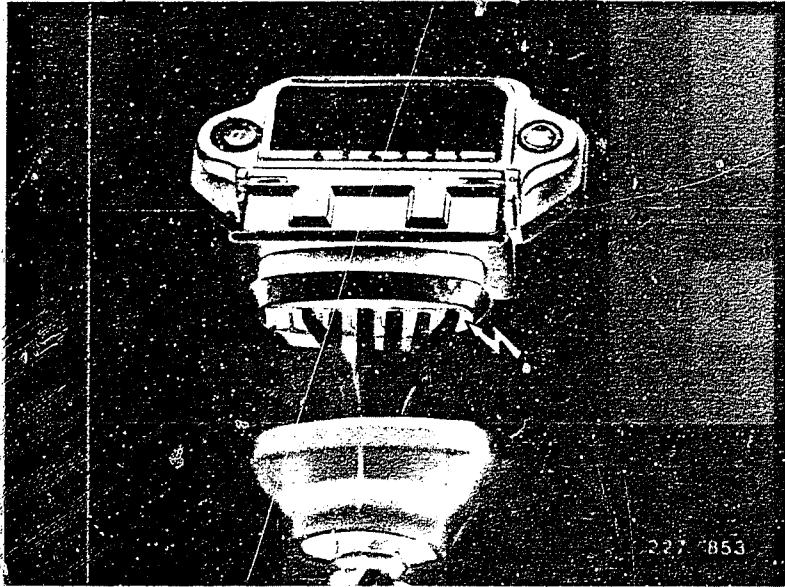
RAPID DIAGNOSIS CHART

| Test step | Test of components/function Test conditions/instructions | Term-inals | Nominal values |
|-----------|--|--------------|---|
| 1 | HIGH-VOLTAGE SIDE visual check (distributor cap, ignition harness etc.) Ignition oscillogram | — | — |
| 2 | IGNITION COIL visual check, sealing plugs present, sealing compound escaped? Primary resistance Secondary resistance | 1 15 1 4 | 0.6...1.0 Ω 6.4...11.1 K Ω |
| 3 | VOLTAGE SUPPLY, CONTROL UNIT Ignition ON. Voltage, trigger box plug | 4 2 + — | approx. V B |
| 4 | PRIMARY CIRCUIT Ignition ON. Voltage, trigger box plug | 1 2 + — | approx. V B |
| 5 | VOLTAGE SUPPLY, SPARK-ADVANCE UNIT Ignition ON. Voltage, spark-advance unit plug | 3 1 + — | approx. V B |
| 6 | VOLTAGE SUPPLY, MAGNETIC PULSE GENERATOR Ignition ON. Voltage, ignition distributor plug | 4 2 + — | > 10 V |
| 7 | FUNCTION, MAGNETIC PULSE GENERATOR Start engine. Test signal, ignition distributor plug and vehicle ground. | 12 B— + — | Rectangular pulse |



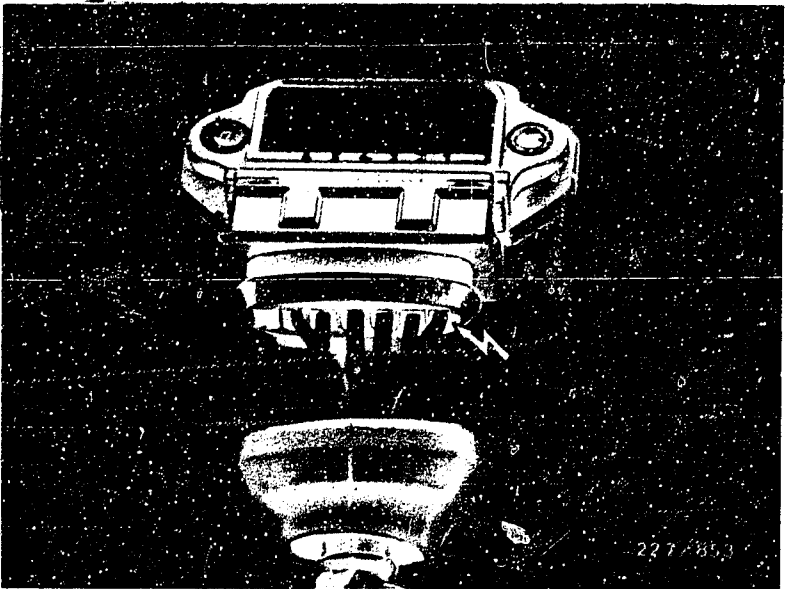
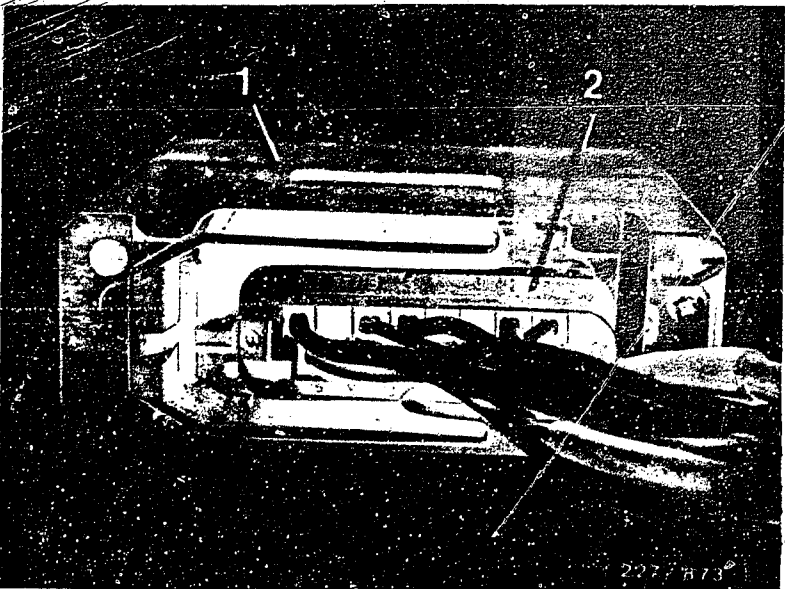
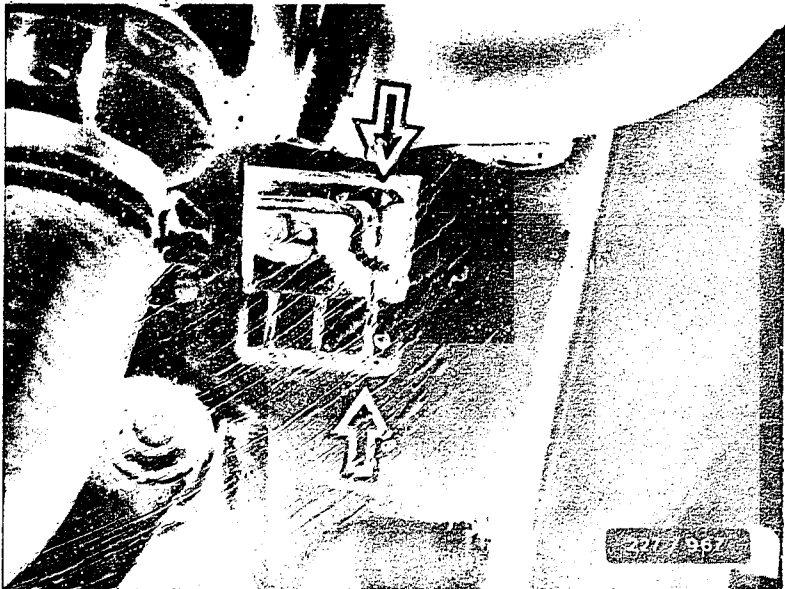
RAPID DIAGNOSIS CHART (continued)

| Test step | Test of components/function Test conditions/instructions | Term. | Nominal values |
|---|---|-------------|------------------------|
| 8 | SPARK-ADVANCE UNIT Plugs for trigger box, ignition distributor, and spark-advance unit are plugged in. Start engine. Test signal at trigger box plug and vehicle ground. | 5 B- + - | Rectangular pulse |
| 9 | ENGINE-SPEED SIGNAL Start engine. Test signal, Jetronic control-unit plug and vehicle ground. | 1 B- + - | Rectangular pulse |
| 10* | IGNITION DISTRIBUTOR ASSEMBLY ADJUSTMENT Engine cyl. 1 TDC. Distributor rotor points to housing marking. | — | — |
| | CONTACT RESISTANCES Test voltage supply leads of trigger box and primary circuit for contact resistances. | | max. 0.3 Ω |
| 11 | THROTTLE-VALVE SWITCH, IDLE Start engine. Voltage, spark-advance unit plug. | 6 1 + - | approx. V _B |
| 12 | THROTTLE-VALVE SWITCH, FULL LOAD Throttle valve open all the way, start engine. Voltage, spark-advance unit plug | 14 1 + - | approx. V _B |
| * Carry out only with engine not running. | | | |



RAPID DIAGNOSIS CHART (continued)

| Test step | Test of components/function Test conditions/instructions | Term. | Nominal values |
|-----------|---|--------------|---|
| 13 | BASIC IGNITION SETTING Plug short-circuit device KDZS 0003 onto throttle-valve switch plug. Run engine in idle, read off ignition point. Increase engine speed. The ignition point must not change. | — | 10° before TDC at 800...900 min ⁻¹ |
| 14 | JETRONIC LOAD SIGNAL Dwell angle, spark-advance unit plug and battery positive terminal with engine idling. Accelerate <u>briefly</u> . | 15 B+ — + | Change in dwell angle |
| 15 | VOLTAGE SUPPLY, SPARK-ADVANCE UNIT Voltage, spark-advance unit plug with handle cover removed and engine in idle | 3 1 + — | 12...14 V, max. 1 V below V _B |
| 15 | VOLTAGE SUPPLY, TRIGGER BOX Voltage, trigger-box plug with engine in idle | 4 2 + — | 12...14 V, max. 1 V below V _B |
| 16 | VOLTAGE SUPPLY, IGNITION COIL Engine in idle. Voltage, ignition coil and battery terminal negative | 15 B- + — | > 10 V |
| 17 | PRIMARY VOLTAGE Voltage, ignition coil with engine idling. | 15 1 + — | 295...365 V |



TEST SPECIFICATIONS

| | |
|------------------------|----------------|
| Ignition coil, primary | 0,6...10 Ω |
| secondary | 6,4...11,1 k Ω |

Basic ignition setting at engine speed of 800...900 min⁻¹ 10 ° before TDC

| | |
|---|-----------|
| Voltage supply, spark-advance unit with engine idling | 12...14 V |
|---|-----------|

Voltage supply, trigger box with
engine idling 12...14 V

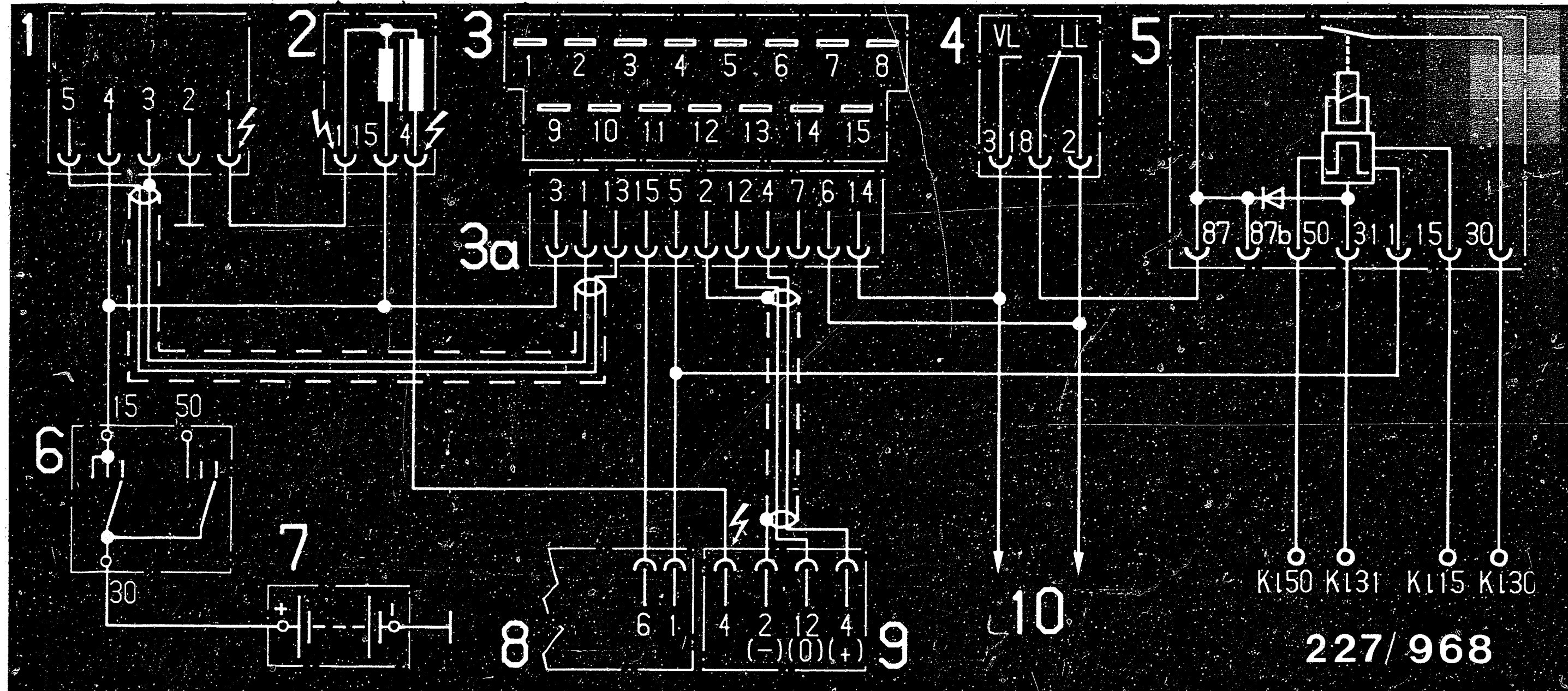
Voltage supply, ignition coil
with engine idling > 10 V

Primary voltage
with engine idling 295...365 V

Voltage supply, magnetic pulse generator with ignition on > 10 V

For adjustment values for idle speed, exhaust, valve play etc., see Autodata test specifications.

For production reasons:
continued on the following
coordinate.



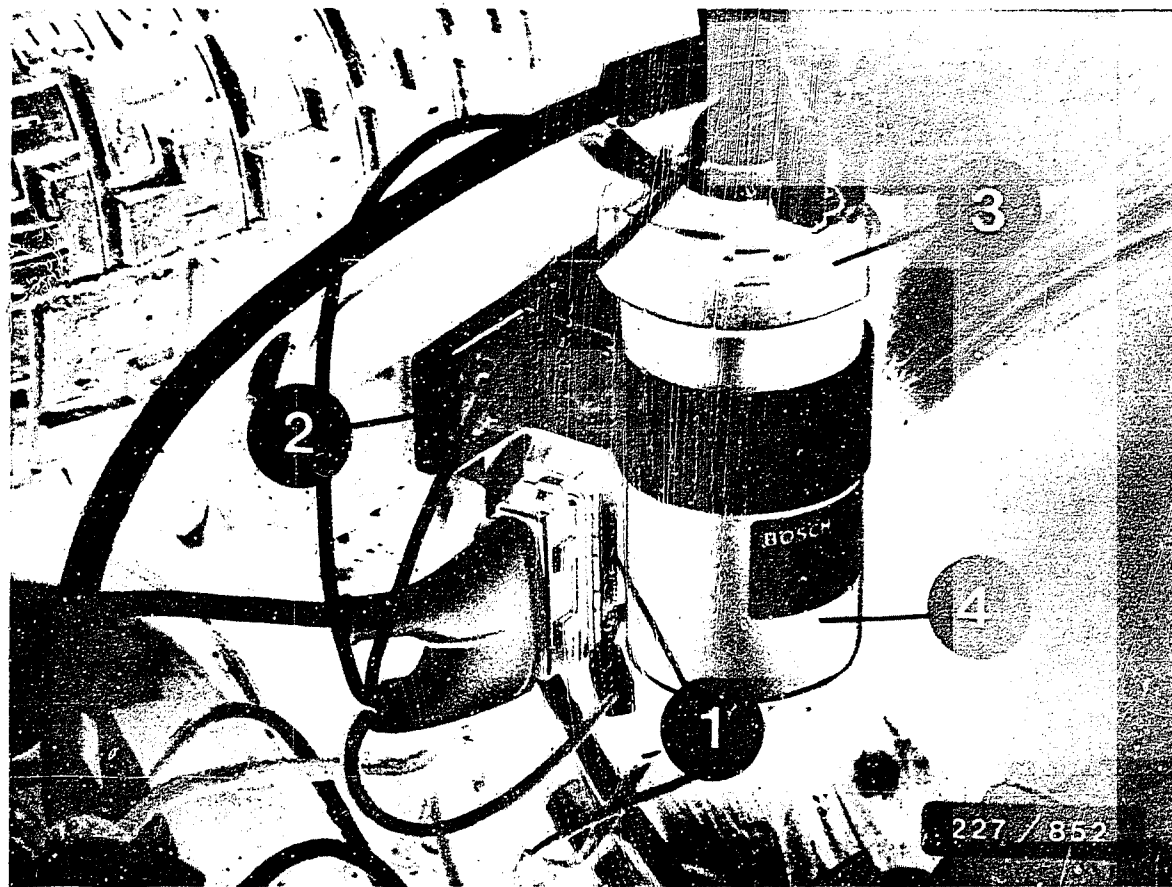
High-voltage arrows = hazardous voltages (400 V - 25 kV)

- | | | |
|-----------------------------|----------------------------------|-------------------------------|
| 1 = Trigger box | 5 = Jetronic control relay | 9 = Ignition distributor |
| 2 = Ignition coil | 6 = Ignition and starting switch | 10 = To Jetronic control unit |
| 3 = Spark-advance unit plug | 7 = Battery | |
| 3a = Spark-advance unit | 8 = Jetronic control unit | |
| 4 = Throttle-valve switch | | |

ELECTRICAL TERMINAL DIAGRAM

B13

B14

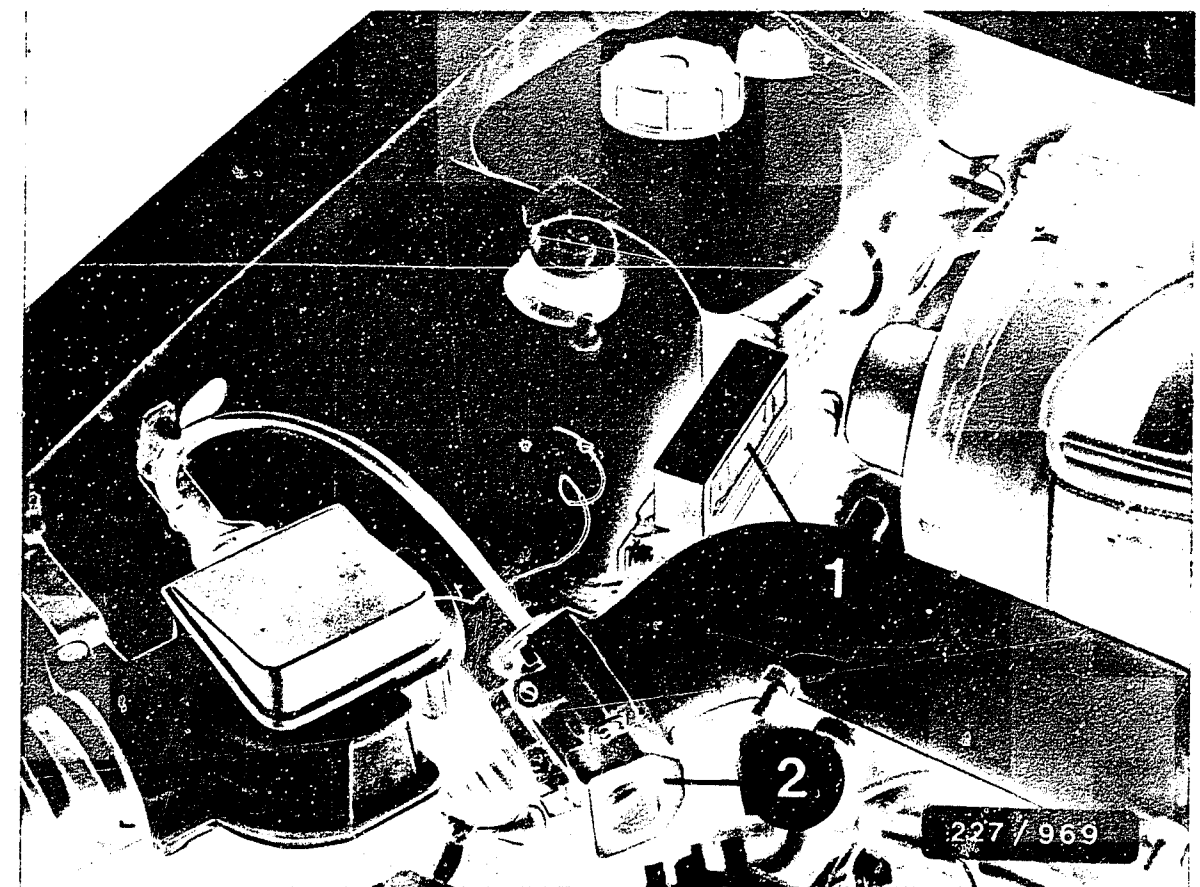


- 1 = TI trigger box
- 2 = Cooling plate
- 3 = Protective cap
- 4 = Ignition coil

INSTALLATION POSITION OF COMPONENTS

The trigger box and ignition coil are mounted on the same cooling plate, see illustration.

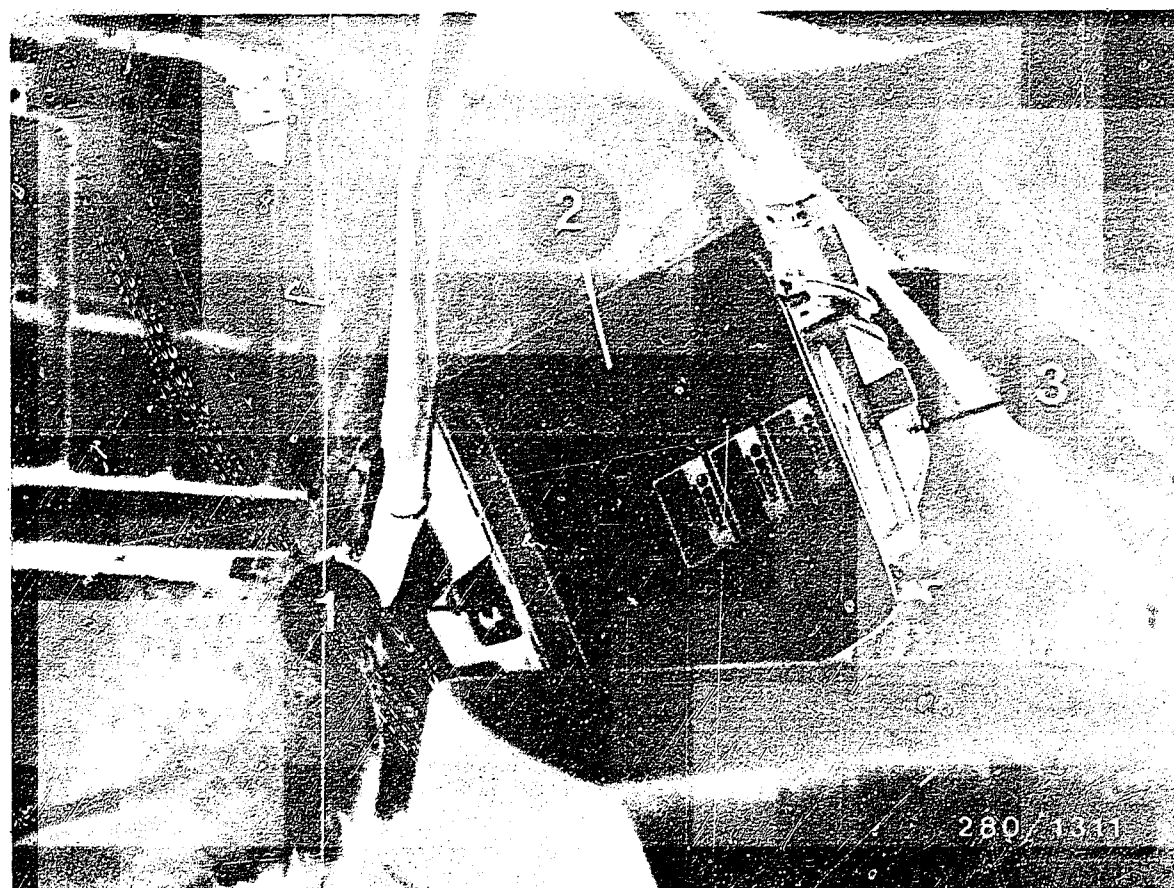
The Jetronic control unit is located behind the ignition coil (not visible in illustration).



- 1 = Spark-advance unit
- 2 = Throttle-valve switch

INSTALLATION POSITION OF COMPONENTS (continued)

To remove the spark-advance unit, remove the air filter.



- 1 = Fastening screw
- 2 = Jetronic control unit
- 3 = Control-unit plug

INSTALLATION POSITION OF COMPONENTS (continued)

The Jetronic control unit is located in the passenger compartment on the passenger side on the facewall of the footwell. To remove it, loosen the panel on the right and push it to the left.

For production reasons:
continued on the following
coordinate.

Trouble-shooting instructions : PEU - 5002
Bosch system : VE - EDC
Vehicle make : PEUGEOT
Basic microcard : PKW-024

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| Installation position of components, instructions on removal and installation..... | see basic instructions |

SPECIAL FEATURES

These brief instructions apply to the following Peugeot model current at the time of writing:

505 Turbo-Diesel
with electronic control of diesel fuel
injection (EDC = Electronic Diesel Control)

Engine: XD3T 2.5 l, 70 kW (95 bhp)
EU, USA 03.87 ->

USE

These brief instructions essentially contain vehicle-specific special features and test specifications (nominal values).

The trouble-shooting chart leads to the various causes/component defects on the basis of the customer complaint. Detailed instructions on trouble-shooting can be found using the trouble-shooting chart of the basic instructions.

NOTE:
The nominal values, terminal assignments, and special features of these vehicle-specific brief instructions are always binding even when reference is made to a basic instruction.

SAFETY AND PRECAUTIONARY MEASURES

Always observe these measures in order to prevent damage to the engine, control units and peripheral components of the EDC.

1. For testing the compression, disconnect the 7-pin connector from the distributor-type-fuel injection pump.
2. In the case of nozzle-holder assemblies inductive start-of-injection sensor, the after-sales service workshop is permitted to perform only a correction of the nozzle-opening pressure.
3. Never start the engine if the battery is not firmly connected.
4. Do not use a fast charger for starting the engine.
Provide starting assistance only using a second 12 V battery and jumper cables.
5. Before fast charging, disconnect the battery from the vehicle electrical system.
6. Never disconnect the battery from the vehicle electrical system when the engine is running.
7. Never disconnect or connect the control-unit plug when the ignition is switched on.
8. At temperatures above + 80° C (paint-drying installation), remove the control units.
9. When welding (electric spot welding), remove the control units.

TROUBLE-SHOOTING CHART

Customer complaint (symptom of trouble)

1. Trouble lamp lights up/blinks
2. Starting motor operates, engine does not start or starts only with difficulty (hot or cold)
3. Engine surges in idle
4. Uneven idle with engine warm
5. Excessive fuel consumption together with inadequate engine power and smoke formation
6. Unsatisfactory performance
7. Black smoke in full-load range together with rough engine running, poss. insufficient power
8. Rough engine running

| Cause (component fault) | | | | | |
|-------------------------|---|---|---|---|--|
| * | | | | | Self-diagnostics |
| * | | | | | Voltage supply, control units |
| * | | | | | Electromagnetic actuator for quantity |
| * | | | | | Angle potentiometer |
| * | | | | | ELAB |
| * | | | * | * | Computer monitoring |
| | | | * | * | Solenoid-valve - start of injection |
| | | | * | | EGR pressure transducer |
| | | | * | | Nozzle-holder assemblies with NMS |
| | | | * | | Computer linkage |
| | * | | | * | Engine-speed sensor |
| * | | | | | Engine-speed sensor and NMS |
| * | | | | | Tank empty, tank ventilation |
| * | * | | * | | Injection sequence not ignition sequence |
| | * | | | | Reducer bushing, supply/return flow |
| * | * | | | | Air in fuel system |
| * | | | | | Paraffin deposits |
| * | | * | | | Leakage in fuel lines |
| * | | | | | Supply lines blocked |
| * | * | * | * | * | Fuel-injection nozzles |
| * | * | * | * | * | Pump-engine coordination |
| * | | | | | Fuel filter |
| * | | | | | Preheating system |
| * | * | * | | | Compression - engine |
| * | * | * | * | * | Fuel-injection pump |
| | | * | | | Engine air filter |
| | | * | | | Engine timing |
| | | | * | | Timing device |
| | | | * | | Turbo-supercharger |

TROUBLE-SHOOTING CHART (continued)

Customer complaint (symptom of trouble)

9. Engine missing during vehicle operation

10. Engine cuts off automatically

11. Engine runs at constant speed

12. Engine will not rev up in cold condition

13. Increased idle speed or uneven engine running at high engine speeds

14. Black smoke in full-load range

15. Fog-like smoke (white) in full-load range

Cause (component defect)

| | | | | |
|---|---|---|--|--|
| * | * | | | Accelerator pedal |
| * | | | | Electromagnetic actuator for quantity |
| * | | * | | Angle potentiometer |
| * | | | | Computer monitoring |
| * | | | | Engine-speed sensor and NMS |
| * | * | * | | * Tank empty, tank ventilation |
| * | * | * | | * Injection sequence not ignition sequence |
| * | | * | | * Reducer bushings supply/return flow |
| * | | * | | * Air in fuel system |
| | | * | | Paraffin deposits |
| * | | | | Leakage in fuel lines |
| * | | * | | * Supply lines plugged |
| | | * | | * Pump-engine coordination |
| | | * | | * Fuel filter |
| | | * | | Compression, engine |
| | | * | | * Fuel-injection pump |
| | | * | | * Exhaust-gas recirculation |

TROUBLE-SHOOTING CHART

Customer complaint (symptom of trouble)

16. Cruise control (FGR) not functioning

17. Cruise control cannot be switched off

18. Road speed cannot be reassumed

19. Exhaust-gas recirculation not functioning

Cause (component defect)

| | | | | |
|---|---|--|--|---|
| * | * | | | Computer monitoring |
| * | * | | | Solenoid-operated valve - start of inj. |
| * | * | | | EGR pressure transducer |
| * | * | | | Nozzle holders with NMS |
| * | * | | | Engine-speed sensor |
| * | * | | | Road-speed sensor |
| * | | | | Transmission-shift valve |
| * | | | | Cruise-control ON switch |
| * | * | | | Clutch/brake switch |
| * | * | | | Cruise-control OFF switch |
| | * | | | Cruise-control ACTIVATE switch |
| | * | | | Air-flow sensor |
| | * | | | Temperature sensor - air |
| | * | | | Temperature sensor - engine |

TROUBLE-SHOOTING

* Using the self-diagnosis

The control units of the electronically controlled diesel fuel injection (EDC = Electronic Diesel Control) have a self-diagnosis system at their disposal for the purpose of detecting defective peripheral components and/or line paths.

Therefore, always begin trouble-shooting (testing) with self-diagnosis.

If several faults are present and can be called up in turn via the self-diagnosis, make a note of the flashing-code data. If the voltage supply for the control units is interrupted, the faults stored are cleared. As a result, faults which momentarily cannot be registered (e.g. intermittently occurring loose contacts) cannot be identified as the cause of trouble.

If a faulty function path is indicated, pay particular attention to:

- * Loose contacts at multiple plug
- * Fouled, deformed or corroded plug-in contacts.
- * Breaks in leads at kinked or pinched locations.

Test information:

Before disconnecting or connecting control-unit plugs, switch off the ignition.

Clear the flashing code of the fault stored and trigger self-diagnosis once again as a check.

SELF-DIAGNOSIS VIA FLASHING-CODE EVALUATION

An integrated self-diagnosis system in the two control units (output through control unit 2 only) makes it possible to locate a faulty component or line path via a flashing code. Indication is given by means of an indicator lamp in the instrument panel, this lamp lighting or flashing in the case of a fault (illustration a).

The diagnostic program is activated by pressing the diagnostic button (Test).

The program then starts with a start code 1.2 (= 1 flashing pulse - pause - 2 flashing pulses) and ends with an end code 1.1.

Flashing-code evaluation

1. Actuate the diagnostic button (Test) for at least 1 second in order to avoid incorrect tripping.
2. Start code 1.2 of the diagnosis program is indicated.
3. Wait until the indicator lamp lights up again and then actuate the test switch once again.
4. Flashing code of the corresponding faulty component is indicated.
5. Actuate the diagnostic button again. If there is no further fault, the end code 1.1 is indicated.

Clearing the flashing code

1. Switch on the ignition.
2. Actuate the brake pedal and test switch simultaneously for at least 1 second.
3. Call up the diagnosis program anew by pressing the diagnostic button.
4. If the end code 1.1 is indicated after the start code 1.2, the stored flashing code for the respective faulty component is cleared.

* Breakdown of self-diagnosis (flashing code)

- 1.1 Program end code
- 1.2 Program start code
- 1.3 Temperature sensor (intake air) *
- 1.4 Temperature sensor (coolant) *
- 1.5 Fuel-temperature sensor *
- 2.1 Accelerator pedal
- 2.2 Rotational-angle potentiometer
- 2.3 Delivery controller
- 2.4 Road-speed sensor *
- 2.5 Pressure transducer, road-speed control *
- 3.1 Atmospheric-pressure sensor *
- 3.3 Air-flow sensor
- 3.4 Pressure transducer, exhaust-gas recirculation
- 4.1 Engine-speed sensor
- 4.2 Needle-movement sensor
- 4.3 Solenoid-operated-valve start of injection
- 5.1 Computer interface, control unit (stored fault)
- 5.2 Computer interface, control unit (present fault) and/or computer monitoring, control unit 1

Steady light (flashing code cannot be called up)
Computer monitoring, control unit 2

Note:

* = Slight fault, indicator lamp of self-diagnosis goes out 30 seconds after the engine has been started.

SELF-DIAGNOSIS TEST TABLE

| Defect-indic. Blink code | Test of component/function | Test instructions/conditions | Terms. | Nominal values |
|-----------------------------|------------------------------------|--|---|---|
| 1.3 | Temperature sensor (intake air) | Test resistance at air-flow sensor at +15...+30°C. Test measurement voltage (control unit) at disconnected cable connector. | 1 - 4 1 - 4 | 1.3...3.6 k Ω approx. 5 V |
| 1.4 | Temperature sensor (coolant) | Test resistance at component. +15...+30°C: approx. 80°C: Test measuring voltage (control unit) at disconnected cable connector. | | 1.3...3.6 k Ω 250...390 Ω approx. 5 V |
| 1.5 | Temperature sensor, fuel | Carry out tests at 7-pin cable plug for the EDC-VE pump with the help of test adapter KDEP 1160 or KDEP 1165. * Ground connection Connect adapter to cable connector for fuel-injection pump * Short circuit Connect adapter to cable connector for fuel-injection pump * Internal resistance at +15...+30°C: (Connect adapter to cable connector for fuel-inj. pump) * Measuring voltage (control unit): (Connect adapter to cable connector for control unit) | 5 - gr. 6 - gr. 4 - 6 5 - 6 5 - 6 | > 1 M Ω > 1 M Ω > 1 M Ω 1.2...4.0 k Ω approx. 5 V |
| 2.1 | Accelerator pedal | Carry out tests on component. * Internal resistance * Supply voltage * Voltage signal - idle position - full-load position | 1 - 3 1 - 3 (-) (+) 1 - 2 1 - 2 | 1.6...2.4 k Ω 4.8...5.2 V 0.45...0.55 V 4.00...4.50 V |

SELF-DIAGNOSIS TEST TABLE (CONTINUED)

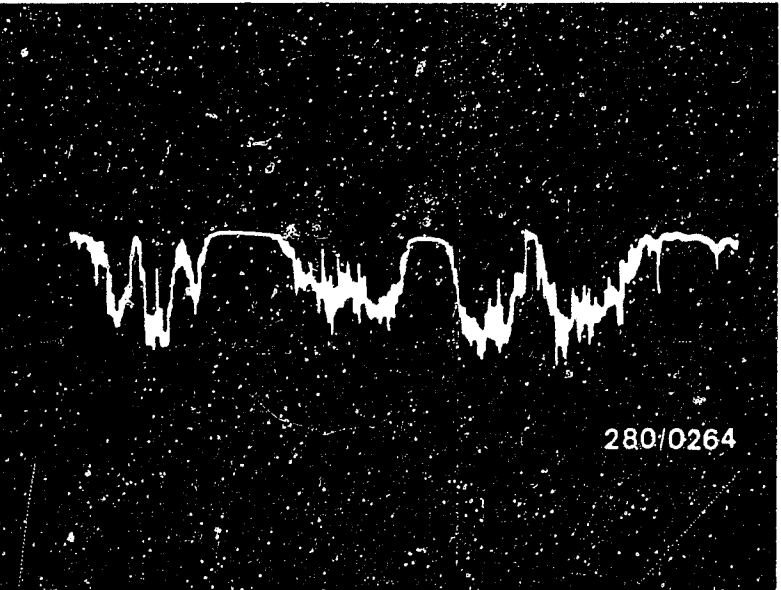
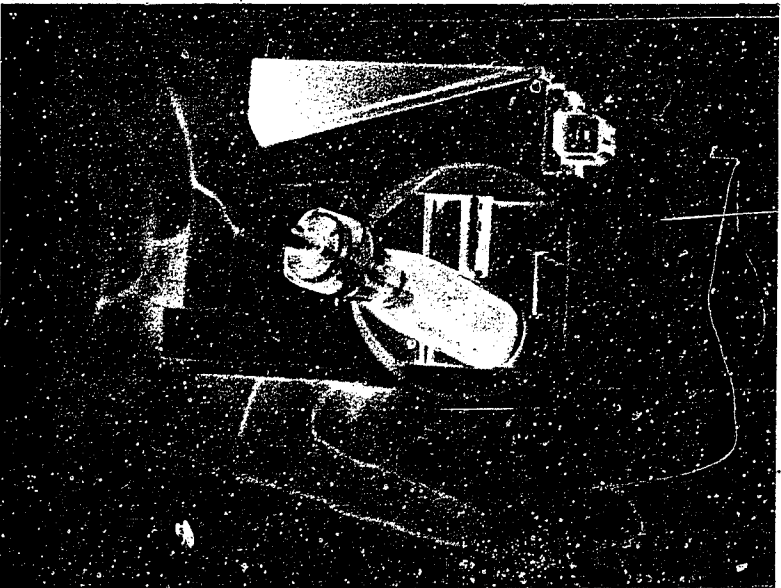
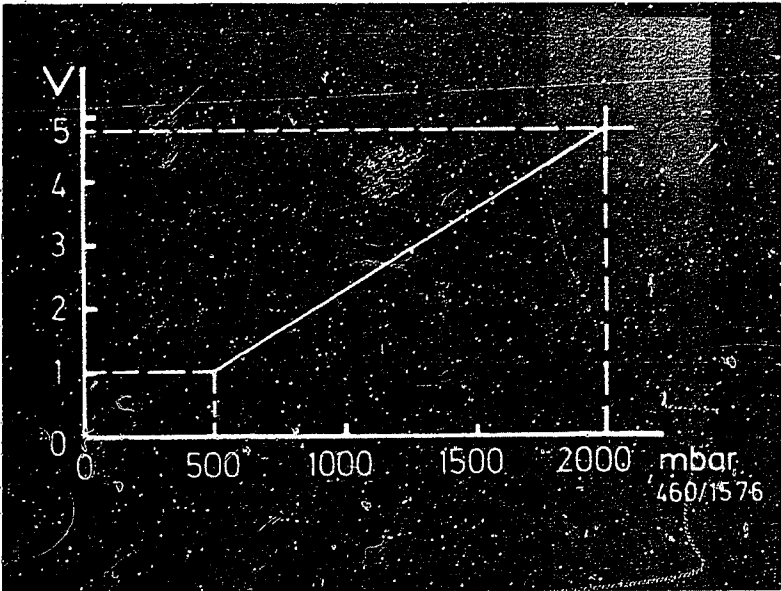
| Defect-indic. Blink code | Test of component/function | Test instructions/conditions | Terms. | Nominal values |
|-----------------------------|-------------------------------|--|--|----------------|
| 2.2 | Angle potentiometer | <p>Carry out tests at 7-pin cable connector of EDC-VE pump with the help of test adapter KDEP 1160 or KDEP 1165.</p> <p>* Ground connection Connect adapter to cable connector for fuel-injection pump</p> <p>* Short circuit Connect adapter to cable connector for fuel-injection pump</p> <p>* Resistance - potentiometer path Connect adapter to cable connector for fuel-inj. pump.</p> <p>* Resistance - slider path Connect adapter to cable connector for fuel-inj. pump.</p> <p>* Supply voltage Connect adapter to cable connector for control unit.</p> <p>* Voltage signal Connect both cable connectors to adapter. Disconnect cable connectors at temperature sensor 2 (engine) and needle-motion sensor (NMS). Plug in cable connector to NMS.</p> | <p>1 - gr. > 1 M Ω 2 - gr. > 1 M Ω 3 - gr. > 1 M Ω</p> <p>2 - 7 > 1 M Ω</p> <p>2 - 3 1.0...10.0 k Ω</p> <p>1 - 3 500 Ω ... 5.00 k Ω</p> <p>2 - 3 4.8...5.2 V (+) (-)</p> <p>1 - 3 2.0...2.3 V > 3.0 V</p> | |

SELF-DIAGNOSIS TEST TABLE (CONTINUED)

| Defect-indic. Blink code | Test of component/function | Test instructions/conditions | Terms. | Nominal values |
|-----------------------------|------------------------------------|--|---|--|
| 2.3 | Quantity control | <p>Carry out testing at 7-pin cable connector for EDC-VE pump with the help of test adapter KDEP 1160 or KDEP 1165.</p> <p>* Ground connection Connect adapter to cable connector for fuel-inj. pump.</p> <p>* Internal resistance Connect adapter to cable connector for fuel-inj. pump.</p> <p>* Supply voltage Connect adapter to cable connector for control unit.</p> | <p>4 - gr. > 1 M Ω 7 - gr. > 1 M Ω</p> <p>4 - 7 0.3...1.2 Ω</p> <p>3 - 7 8.0...14.5 V (-) (+)</p> | |
| 2.4 | Road-speed sensor | <p>Test internal resistance at components at +15...+50°C.</p> <p>Test measuring voltage (control unit) at disconnected cable connector.</p> | | <p>240...350 Ω</p> <p>approx. 5 V</p> |
| 2.5 | Cruise-control pressure transducer | <p>Test internal resistance at components at approx. +20°C.</p> <p>Test measuring voltage (control unit) at disconnected cable connector.</p> | | <p>5.0...6.0 Ω</p> <p>approx. 12 V</p> |

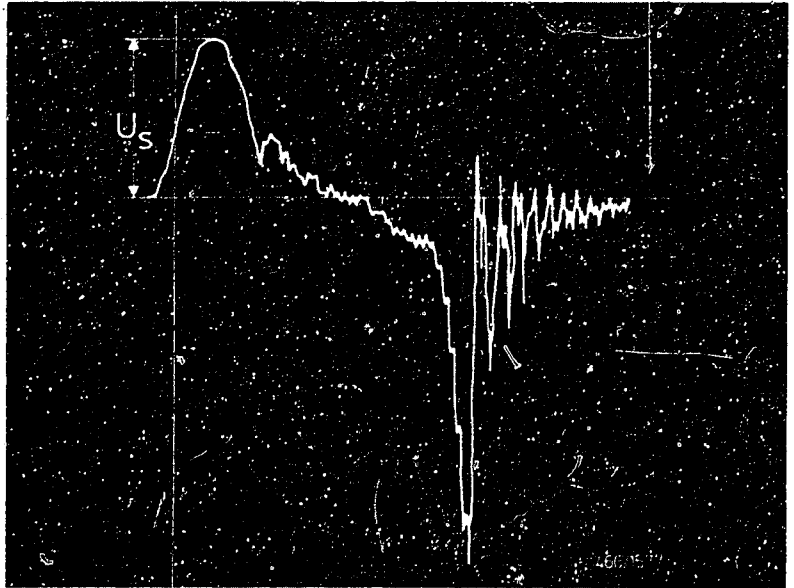
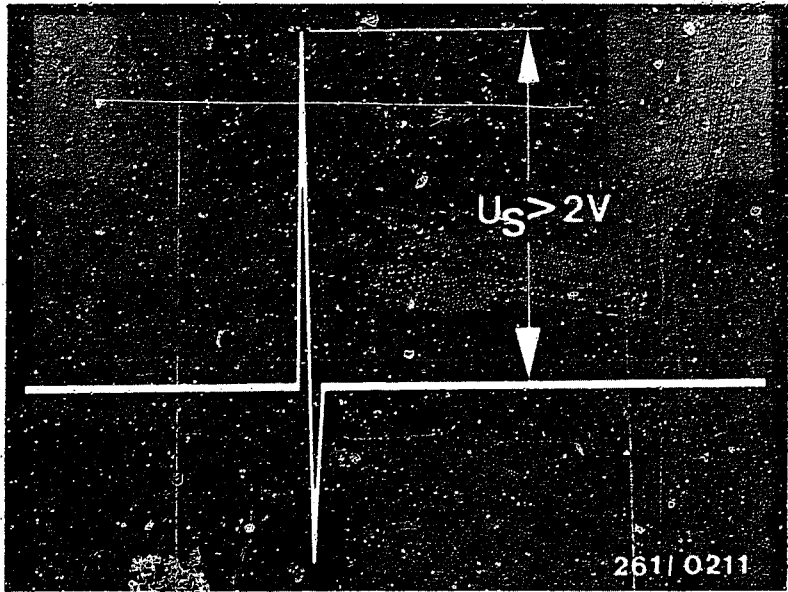
SELF-DIAGNOSIS TEST TABLE (CONTINUED)

| Defect-indic. Blink code | Testing of component/function Test instructions/conditions | Terms. | Nominal values |
|-----------------------------|---|---|---|
| 3.1 | Atmospheric-pressure sensor. Carry out testing at component. * Supply voltage * Voltage signal (find out barometric pressure) | 1 - 3 1 - 2 | 4.8...5.2 V see characteristic curve |
| 3.3 | Air-flow sensor. Carry out testing at component. * Overall resistance * Supply voltage * Voltage signal - By changing the air-flow sensor flap position * Noise test - Motortester, special input | 3 - 4 3 - 4 (+) (-) 2 - 4 2 - 4 | 500...1000 Ω 4.8...5.2 V 0.25...4.65 V Noise signal in case of defective air-flow sensor (see illustration) |
| 3.4 | Exhaust-gas recirculation press. transd. * Test internal resistance at component at approx. + 20°C. * Test measuring voltage (control unit) at component cable connector * Actuation on-off ratio - Coolant temperature approx. + 80°C - Connect pocket tester to pressure transducer - Set for dwell angle - Operate engine at idle speed - Disconnect cable connector at temperature sensor (coolant) or air-flow sensor. Note for testing: The on-off ratio should change when one of the components is unplugged. | | 5.0...6.0 Ω approx. 12 V Tester shows the on-off ratio 0...10 % |



SELF-DIAGNOSIS TEST TABLE (CONTINUED)

| Defect-indic. Blink code | Testing of component/function Test instructions/conditions | Terms. | Nominal values |
|-----------------------------|---|--------------------------|---|
| 4.1 | <p>Engine-speed sensor</p> <p>Carry out tests on component cable connector.</p> <ul style="list-style-type: none">* Ground connection* Internal resistance at approx. + 20°C* Engine-speed signal image<ul style="list-style-type: none">- Motortester, special input- Operate engine at idle speed <p>Note: Positive signal peak must come first</p> | <p>1 - 2 (+) (-)</p> | <p>> 1 M Ω</p> <p>900...1100 Ω</p> <p>see upper signal image</p> |
| 4.2 | <p>Needle-motion sensor - carry out tests on component cable connector.</p> <ul style="list-style-type: none">* Ground connection* Internal resistance approx. + 20°C approx. + 80°C* Supply voltage<ul style="list-style-type: none">- Cable connector disconnected- Cable connector connected at approx. + 80°C* Valve-lift signal/signal voltage (U_s)<ul style="list-style-type: none">- Cable connector connected- Operate engine at idle speed- Motortester special input, or use oscilloscope | | <p>> 1 M Ω</p> <p>90...110 Ω 111...135 Ω</p> <p>10.0...12.0 V 2.5... 6.0 V</p> <p>See signal image</p> <p>$U_s = > 150 \text{ mV}$</p> |



SELF-DIAGNOSIS TEST TABLE (CONTINUED)

| Defect-indic. Blink code | Testing of component/function | Test instructions/conditions | Terms. | Nominal values | | | | | | | | | |
|-----------------------------|---|--|---------------------|--|---------------------|---------|----|--------|---------|----|---------|--|-------------|
| 4.3 | Start-of-injection solenoid-operated valve | <p>Carry out testing on component cable connector.</p> <ul style="list-style-type: none">* Ground connection* Internal resistance at approx. +60°C* Test measuring voltage (control unit) at disconnected cable connector.* Actuation on-off ratio<ul style="list-style-type: none">- Coolant temperature approx. + 80°C- Connect pocket tester to connected cable connector- Set for dwell angle- Operate engine at idle speed- Unplug cable connector from needle-motion sensor- Plug in cable connector to needle-motion sensor <p>Note for testing: The on-off ratio should change when the needle-motion sensor plug is disconnected or when the engine speed increases</p> | | <p>> 1 M Ω</p> <p>13.0...22.0 Ω</p> <p>approx. 12 V</p> <p>10...30 %</p> <p>20...40 %</p> | | | | | | | | | |
| 5.1 | Computer link, control unit (fault in memory) | <p>Fault not occurring at time of testing. Disconnect control-unit plugs 1 and 2.</p> <p>Test the following leads for open circuits or contact resistance:</p> <table><tr><td>Control-unit plug 1</td><td></td><td>Control-unit plug 2</td></tr><tr><td>Term.14</td><td>to</td><td>term.9</td></tr><tr><td>Term.15</td><td>to</td><td>term.12</td></tr></table> | Control-unit plug 1 | | Control-unit plug 2 | Term.14 | to | term.9 | Term.15 | to | term.12 | | approx. 0 Ω |
| Control-unit plug 1 | | Control-unit plug 2 | | | | | | | | | | | |
| Term.14 | to | term.9 | | | | | | | | | | | |
| Term.15 | to | term.12 | | | | | | | | | | | |

SELF-DIAGNOSIS TEST TABLE (CONTINUED)

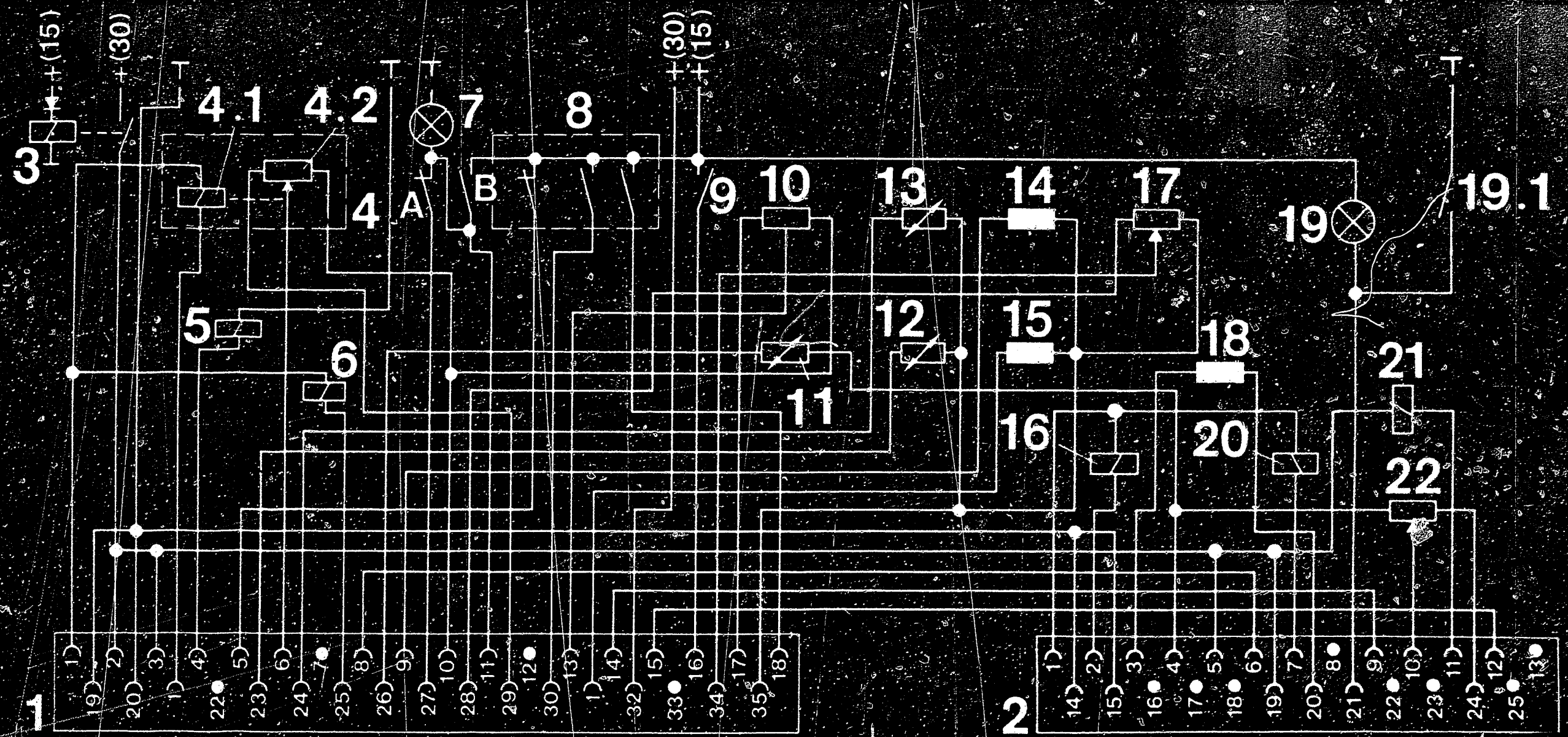
| Defect indic. Blink code | Testing of component/function | Test instructions/conditions | Terms. | Nominal values |
|-----------------------------|--|--|--------|----------------|
| 5.2 | Computer linkage, control unit (current fault) | Fault is present at time of testing. Disconnect cable connector at control-unit plugs 1 and 2. Test the following leads for open circuits and/or contact resistance: Control-unit plug 1 Control-unit plug 22 Term.14 to term.9 Term.15 to term.12 | | approx. 0 Ω |
| 5.2 | Computer monitoring, control unit 1 | There is a defect in the computer monitoring only if the engine <u>cannot</u> be started with the indicated blink code. Replace control unit 1. | | |
| Continuour light | Computer monitoring, control unit 2 | Self-diagnosis indicator lamp lights up and stays lit, and no blink code is indicated when the test button is pressed. Exhaust-gas recirculation switched off. Disconnect cable connector from start-of-injection solenoid-operated valve. Test measuring voltage (control unit) at cable connector. | | approx. 12 V |

TEST SPECIFICATIONS

| Component/function | Nominal values |
|-------------------------------------|---|
| Idle speed: | |
| * Eng. at op. temp. (approx. +80°C) | 730... 830 min ⁻¹ |
| * Engine cold | 950...1050 min ⁻¹ |
| Nozzle-opening pressure: | 150 + 8 bar |
| Coordination of pump and engine: | |
| Setting value engine position | 4th cylinder 1.07 mm before TDC |
| Inspection value engine position | 4th cylinder 1.04...1.10 mm before TDC |
| Setting value pump position | 0.30 mm after BDC |
| Inspection value pump position | 0.28...0.32mm after BDC |
| Charge-air pressure: | 0.8 bar at full load starting at 2000 min ⁻¹ |
| Compression: | 25...30 bar |
| Max. cylinder deviation | 5 bar |

TEST SPECIFICATIONS (CONTINUED)

| Component/function | Nominal values |
|---|----------------------------------|
| Valve clearance — exhaust — intake | 0.25...0.30 mm 0.15...0.20 mm |
| Engine temperature approx. + 20°C | |
| Filter test, max. allowable differential pressure: | 0.3 bar |
| Pressure drop: | max. perm. 25 % |
| Transmission-shift valve Internal resistance | 28...32 Ω |
| Tightening torques | |
| Fuel lines | 25 Nm |
| Fastening screws/ fuel-injection pump | 20 Nm |
| Fastening screws/nozzle- holder assemblies | 70 Nm |
| Sheathed-element glow plugs | 25 Nm |
| Screw plug | 15 Nm |
| Adjusting screw — rocker arm | 15 Nm |
| Fastening nut/ crankshaft belt pulley | 170 Nm |
| Cylinder-head cover screws | 7.5 Nm |



460/1637

- A = Switch, clutch
- B = Switch, brakes
- 1 = Quantity/road-speed control unit (1)
- 2 = EGR/start-of-injection control unit (2)
- 3 = Reversed-polarity protection relay
- 4 = Fuel-injection pump
- 4.1 = Quantity actuator
- 4.2 = Actuator potentiometer
- 5 = ELAB

- 6 = FGR pressure transducer *
- 7 = Stop lamps
- 8 = FGR operating stalk
- 9 = Air conditioner
- 10 = Accelerator pedal
- 11 = Temperature sensor, intake air
- 12 = Temperature sensor, coolant
- 13 = Fuel-temperature sensor
- 14 = Road-speed sensor
- 15 = Engine-speed sensor

- 16 = Timing device
- 17 = Atmospheric-pressure sensor
- 18 = Needle-motion sensor (NMS)
- 19 = Diagnostic display
- 19.1 = Diagnosis request
- 20 = EGR pressure transducer
- 21 = transmission-shift valve *
- 22 = Air-flow sensor

* = only on vehicles with automatic transmission

ELECTRICAL TERMINAL DIAGRAM - EDC

Trouble-shooting instructions : OPE-5000
BOSCH system : L3.1-Jetronic
Make of vehicle : OPEL
Basic microcard : PKW-044

TABLE OF CONTENTS

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SPECIAL FEATURES

These brief instructions, valid at the time of publication, are valid for the following vehicle models with 1.796 1/4-cyl. engine:

OPEL Omega-A 1.8 Injection EU 09.86->

VAUXHALL Astra Right-hand drive GB 09.86->

VAUXHALL Cavalier Right-hand drive GB 09.86->

- * L3.1-Jetronic with 15-pin control unit:
0 280 000 603/604 and ...605/606.
Activated by term.5 of the spark-advanced mechanism.
- * In place of the main and pump relays, one double relay for voltage supply.
- * Throttle-valve switch, idle contact and full-load contact are used also for spark-advance mechanism EZ 61.
- * For testing the fuel pressure, use the pressure gauge and hose lines of the pressure measuring instrument KDJE-P 100.
- * Connect 3-way line KDJE-P 100/13 between the fuel feed line and pressure damper.

STRUCTURE, USAGE

These brief instructions essentially cover the vehicle-specific special features and test specifications (set values).

Corresponding to the customer complaint, the trouble-shooting chart leads to various causes/component faults. Detailed instructions for trouble-shooting must be taken from the basic instructions via the trouble-shooting chart.

NOTE: Even if reference is made to basic instructions, the set values, terminal assignments and special features in these vehicle-related brief instructions are always binding.

The numbering of the test steps is the same for both the brief and basic instructions in order to make it easier to find individual test steps.

SAFETY AND PRECAUTIONARY MEASURES

Keep people out of danger.
Avoid damage to the engine, control unit or ignition system.

* C A U T I O N !

High-performance ignition system.
Dangerous high and low voltages.

Do not come into contact with parts or terminals which carry voltage; danger, primary and secondary sides.

* Avoid injection when testing the compression.
Therefore, disconnect the double relay.

See basic instructions for further precautionary measures.

TROUBLE-SHOOTING CHART

Customer complaint (symptom of trouble)

1. Starting motor operates, but engine fails to start or starts with difficulty.
2. Engine starts but then dies.
3. Rough idling (Speed, exhaust).
4. Poor throttle response, poor progression.
5. Engine misfiring (Ignition, injection).
6. Engine lacks power/maximum speed not obtained.
7. Fuel consumption too high.
8. Engine diesels.
9. Engine pings/knocks.
10. Engine overheats.
11. Fault lamp.

| Cause (component fault) | | | | | | | | | |
|-------------------------|---|---|---|---|---|---|---|---|--|
| * | * | * | * | * | * | * | | * | Universal test adapter |
| * | * | * | * | | * | | | | Air intake system |
| * | * | * | * | | | | | | Auxiliary-air device |
| * | | * | * | * | * | * | | | Air-flow sensor |
| | | | | * | * | | | | Quantity of fuel |
| * | * | * | * | | * | * | * | | Fuel pressure, leakage |
| | | * | | | | | | | Pump noises |
| | | * | | * | * | * | * | | Solenoid-operated injection valves |
| | | | | * | | | | | Generator, interference suppression |
| * | * | * | | | * | | | | Starting control |
| | | | | * | * | | | | Overrun cut-off |
| | | * | * | * | * | | | | Engine-speed adjustment, CO adjustment |

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01
 Adapter lead: 1 684 463 168

| Test step | Switch V | Ω | Term. | Checking of components/operation | Test instructions/ test conditions | Set values |
|-----------|-------------|----------|-------------------|--|---|---|
| 1 | V | 5 | 8 - 5 | Resistance, temperature sensor (engine) | Connect control-unit plug only Engine temperature +15...+30 °C; approx. +80 °C; | 1.45...3.3 k Ω 280...360 Ω |
| 2 | V | 6 | 4 - 5 | Ground of output stage | | 0...10 Ω |
| 3 | - | - | - | Not applicable | | |
| 4 | V | 9 | 15 - 5 | Resistance of throttle- valve switch (idle) | Pull off plug from spark-advance mechanism Throttle valve closed: Throttle valve open : | 0...10 Ω infinite Ω |
| 5 | V | 10 | 14 - 5 | Resistance of throttle- valve switch (full load) | Plug remains disconnected Throttle valve closed : Throttle valve fully open: | inifinite Ω 0...10 Ω |
| 6 | 5 | 10 | 1 - 5 (+) (-) | TN signal from spark- advance mech. term.5 | Connect plug onto spark-advance mechanism Transmission in neutral position, start engine | Rectangular pulse on oscilloscope |
| 7 | 6 | 10 | 2 - 5 (+) (-) | Voltage supply of control unit | Switch on ignition | 8...15 V |
| 8 | 7 | 10 | 12 - 5 (+) (-) | Winding term. 85b/87 of double relay | Switch on ignition | 8...15 V |

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (continued)
 Adapter lead: 1 684 463 168

| Test step | Switch V | Ω | Term. | Testing of components/operation | Test instructions/ test conditions | Set values |
|-----------|-------------|----------|-------------------|---|--|---|
| 9 | 7 | 10 | 12 - 5 | Simulation, activation of electric fuel pump | Pull off lead plug from auxiliary-air device Switch on ignition Press test button 3 | Electric fuel pump running, check by listening |
| 9.1 | 7 | 10 | 12 - 5 | Simulation, activation of auxiliary-air device | Connect lead plug onto auxiliary-air device Switch on ignition Press test button 3 | Restriction closes air-gap area, visual examination |
| 10 | 7 | 10 | 12 - 5 (+) (-) | Ground connection of double relay term.85b via control unit | Connect control unit too Transmission in neutral position, start engine Operate engine at idle speed | 0...5 V |
| 11 | 8 | 10 | 11 - 5 (+) (-) | Air-flow signal UP output term.11 | Leave engine running | 0...5 V depending upon load |
| 12 | - | - | - | Not applicable | | |
| 13 | 10 | 10 | 3 - 5 (+) (-) | Injection pulses from control unit | Leave engine running | Injection pulses on oscilloscope |
| 14 | 11 | 10 | 10 - 5 (+) (-) | Load signal TL output term.10 | Leave engine running | TL rectang. pulses depending upon load |
| 15 | 12 | 10 | 9 - 5 (+) (-) | Reference voltage UV output term.9 | Leave engine running | 3.5...4.5 V |
| 16 | 10 | 10 | 3 - 5 (+) (-) | Simulation, engine cold | Leave engine running, press test button 1 | Injection pulse wider or engine speed lower |

RAPID DIANOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (continued)

Adapter lead: 1 684 463 168

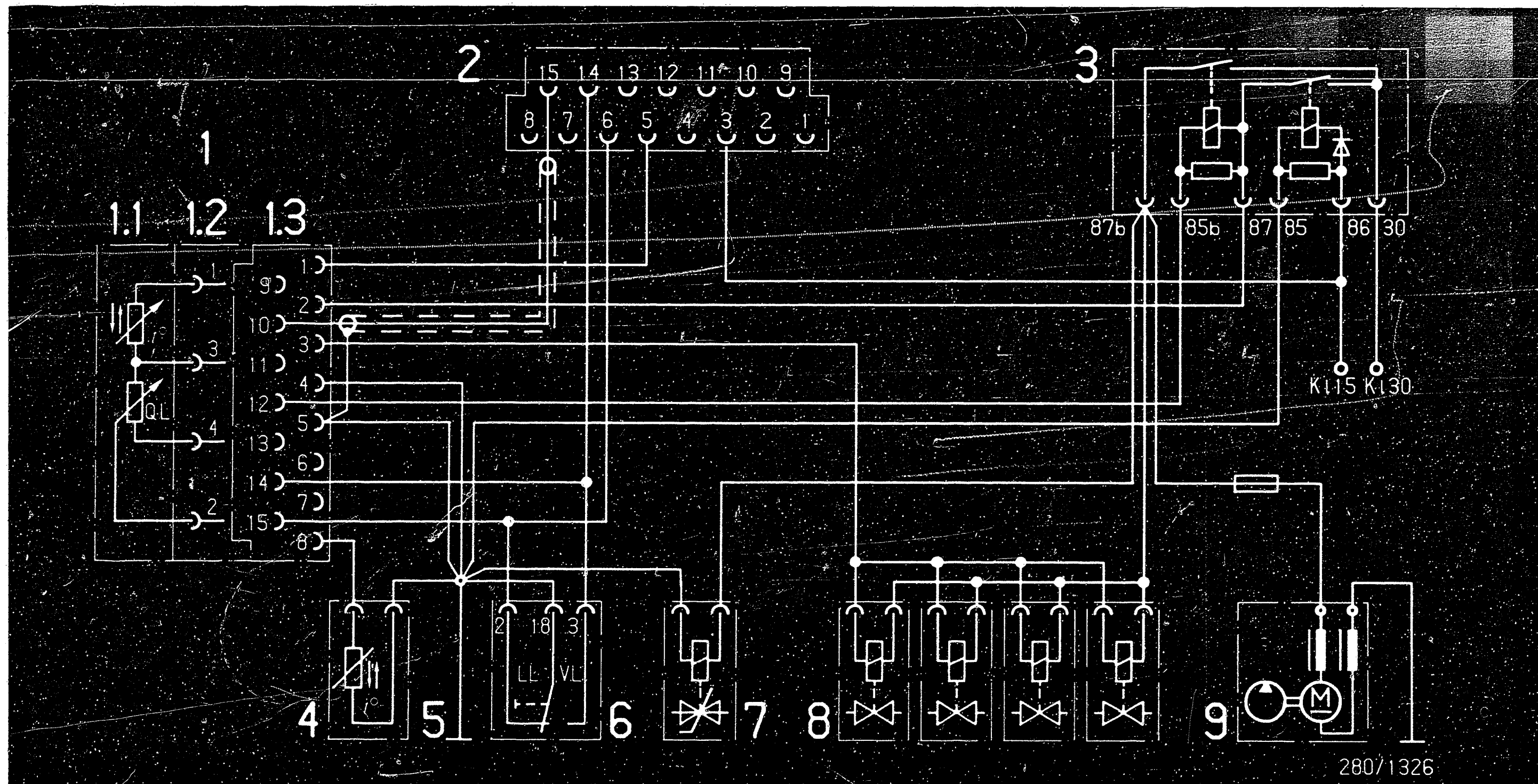
| Test step | Switch | | Term. | Testing of components/operation | Test instructions/ test conditions | Set values |
|-----------|--------|----|------------------|-------------------------------------|--|--|
| | V | Ω | | | | |
| 17 | 10 | 10 | 3 - 5 (+) (-) | Simulation, engine warm | Leave engine running, press test button 2 | Injection pulse must not become wider |
| 18 | 10 | 10 | 3 - 5 (+) (-) | Simulation, overrun cut-off | Leave engine running, engine speed above 2000 min ⁻¹ Press test button 5 | No injection pulse, engine hunts |
| 19 | 10 | 10 | 3 - 5 (+) (-) | Simulation, full-load adjustment | Leave engine running, engine speed approx. 2200 min ⁻¹ Press test button 6 | Low injection pulse and/or change of engine speed. |

TEST SPECIFICATIONS

| Components/operation | Set values |
|---|------------------------------------|
| Electric fuel pump | |
| * Fuel delivery at return: | at least 700 cm ³ /30 s |
| * Supply voltage under load: | at least 12V |
| Pressure regulator | |
| * Fuel pressure with engine not running: | 2,3...2,7 bar |
| at idle speed: | approx. 0.5 bar lower |
| Fuel system, leakage | |
| * Fuel pressure 20 min. after engine switched off: | at least 1.0 bar |
| Auxiliary-air device | |
| * Internal elec. resistance: | 30...65 Ω |
| Air-flow sensor, only measurable if control unit is removed. | |
| * Resistance value between term.3- and term.4- : | 500...1000 Ω |
| term.3- and term.2- : | |
| Air-flow sensor flap in rest position | 10...200 Ω |
| When air-flow sensor flap is deflected, indication must change: | |
| Temperature sensor (intake air), only measurable if control unit is removed. | |
| * Internal electrical resistance, between term.3- and term.1-, at ambient temperature +15...+30 °C: | 1.45...3.3 k Ω |

Test specifications (continued)

| Components/operation | Set values |
|--|--------------------------------|
| Temperature sensor (engine) | |
| * Internal electrical resistance at ambient temperature +15...+30 °C: | 1.45...3.3 k Ω |
| with engine at norm. op. temp. approx. +80 °C: | 280...360 Ω |
| Solenoid-operated injection valve | |
| * Internal electrical resistance at ambient temperature +15...+30 °C: | 14,5...17,0 Ω |
| * Leakage after 60 s: | No drop must fall |
| Starting control | |
| * Voltage at injection valve on starting: | approx. 1.5 V |
| after approx. 15 s | approx. 0.5 V |
| Overrun cut-off | |
| * Reinstatement speed +15°...+30°C: | approx. 1600 min ⁻¹ |
| approx. +80°C: | approx. 1200 min ⁻¹ |
| Idle-speed adjustment | |
| Eng. at norm. op. term., +80°C | |
| * Idle speed: | 850...900 min ⁻¹ |
| * CO concentration: | 0,4...1,0 % by vol. |
| See equipment and Autodata microcard for settings for ignition, valve clearance and other engine-related data. | |

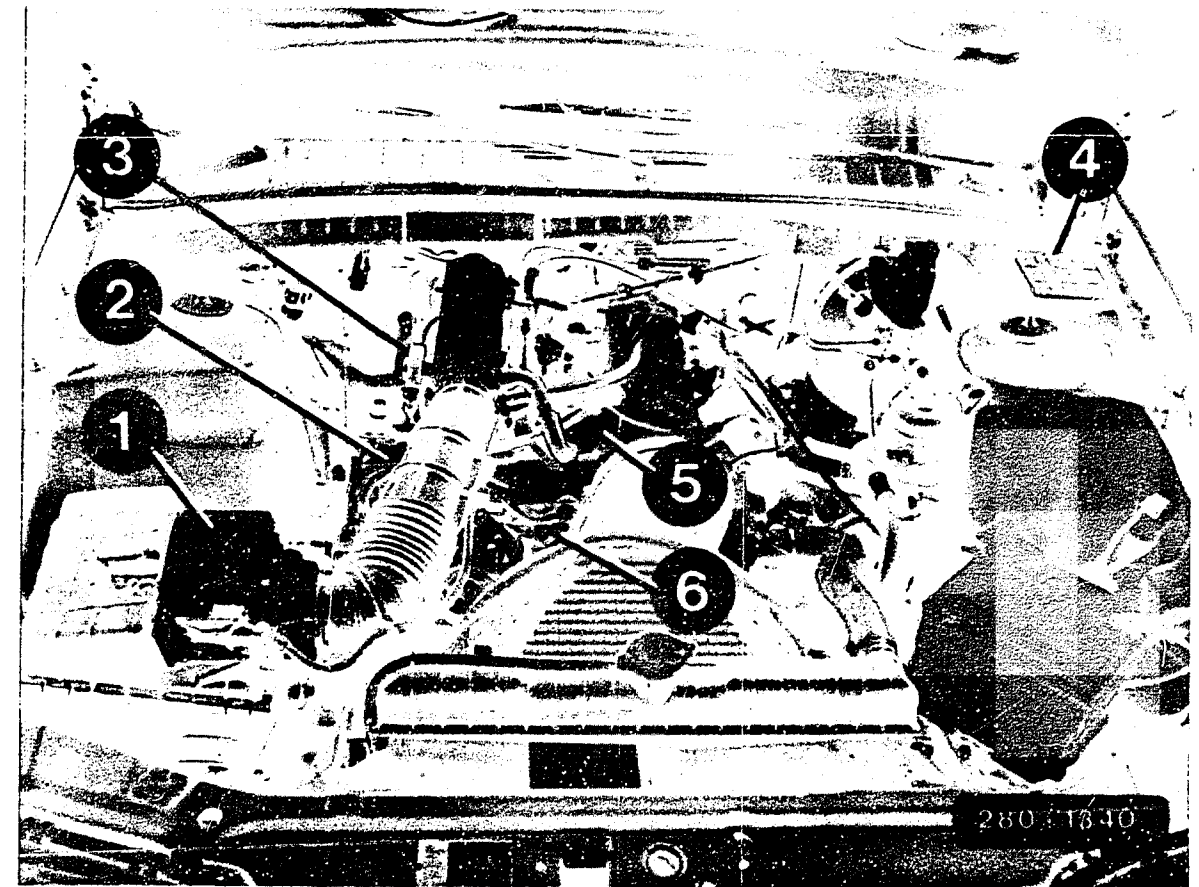


280/1326

ELECTRICAL TERMINAL DIAGRAM

- | | |
|---|--|
| 1 = Measuring and control assembly | 4 = Temperature sensor (engine) |
| 1.1= Air-flow sensor with temperature sensor (intake air) | 5 = Central ground (elec. and output stage) |
| 1.2= Control unit | 6 = Throttle-valve switch (idle and full load) |
| 1.3= Control-unit plug, 15-pin | 7 = Auxiliary-air device |
| 2 = Spark-advance mechanism | 8 = Solenoid-operated injection valves |
| 3 = Double relay | 9 = Electric fuel pump |

For production reasons:
continued on the following
coordinate.

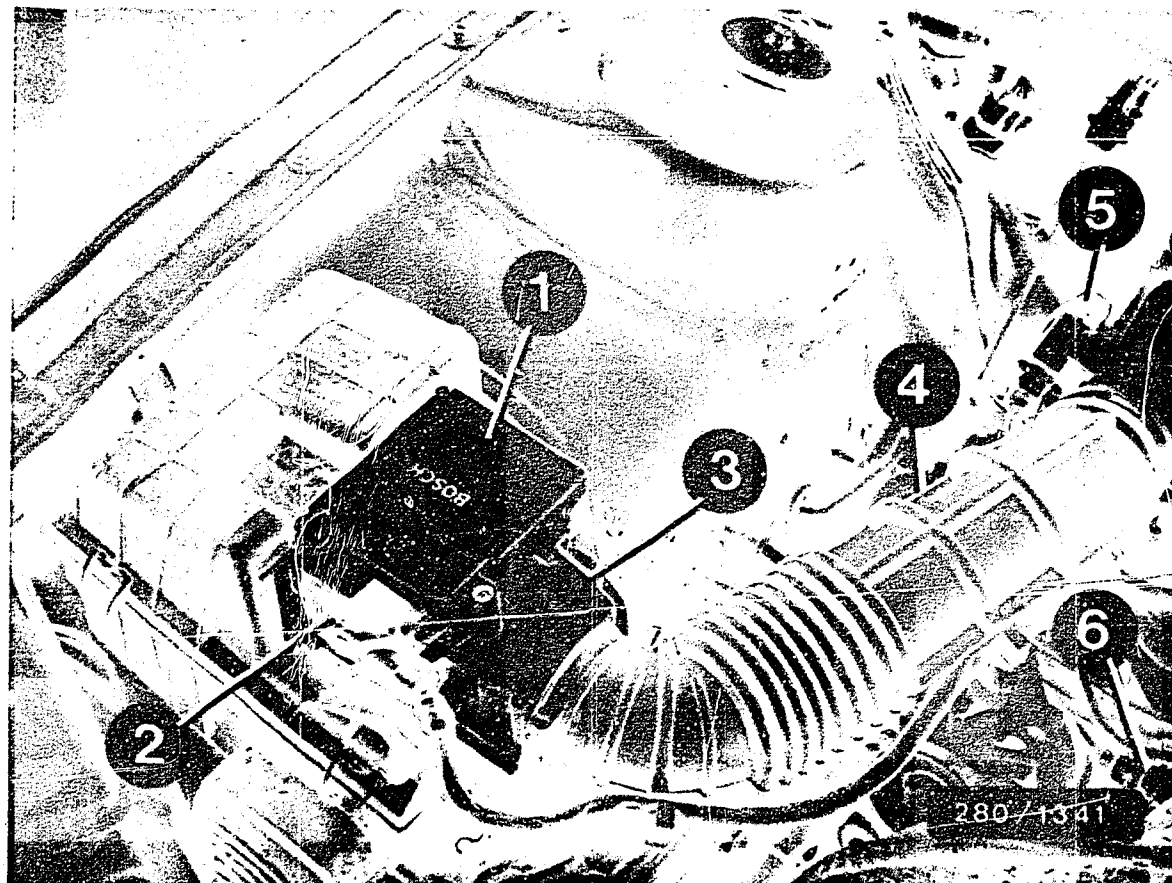


INSTALLATION POSITION OF COMPONENTS

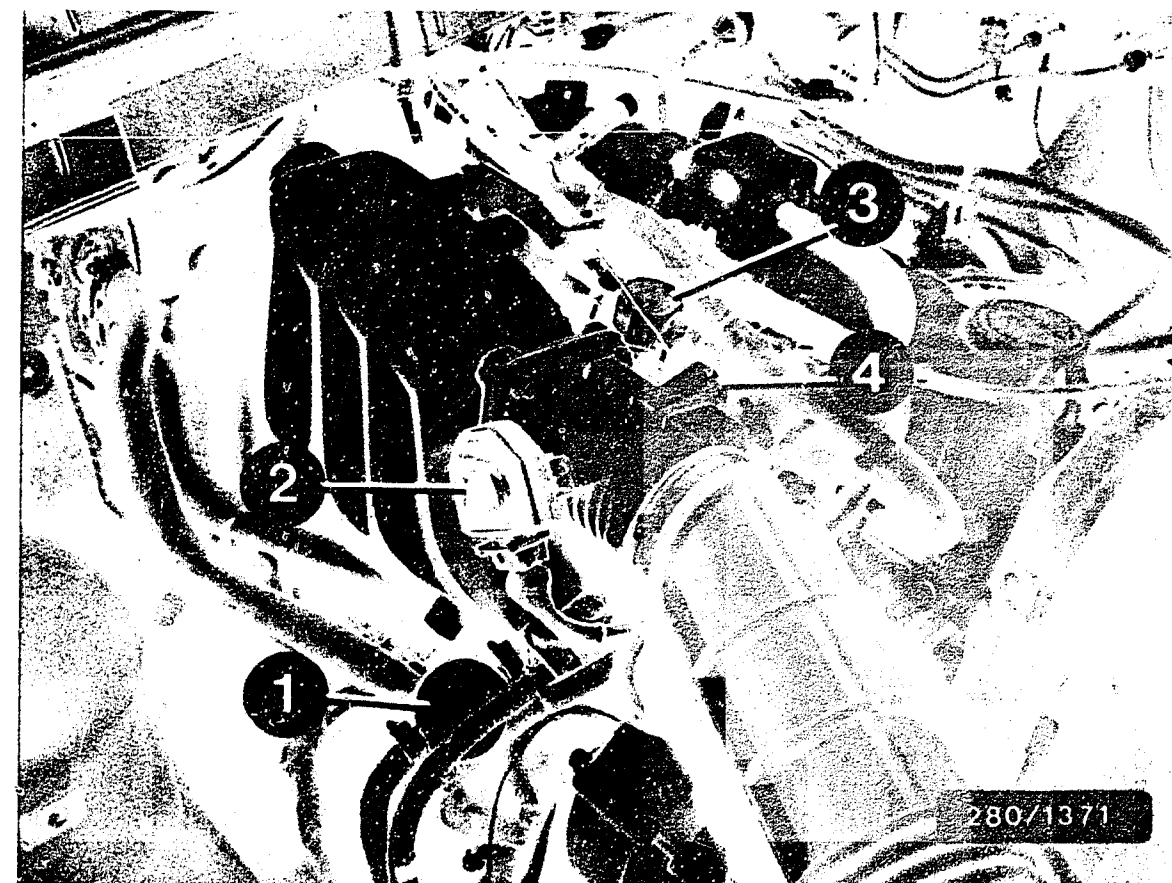
The indications "right" and "left" refer
always to the forward direction of travel.

Arrangement of components in engine compartment.

- 1 = Measuring and control unit
- 2 = to pressure damper
- 3 = Throttle-valve switch
- 4 = Double relay (under cover)
- 5 = Auxiliary-air device
- 6 = Temperature sensor (engine)



- 1 = Measuring and control unit consisting of air-flow sensor and control unit
- 2 = 15-pin control-unit plug
- 3 = CO adjusting screw with anti-tamper cap
- 4 = to pressure damper
- 5 = Throttle-valve switch
- 6 = Temperature sensor (engine)



- 1 = Pressure damper
- 2 = Throttle-valve switch
- 3 = Auxiliary-air valve
- 4 = Idle-speed bypass screw

*The double relay is positioned beneath a covering behind the left-hand McPherson strut dome.

When testing, e.g. fuel delivery or fuel pressure, the safety circuit must be bridged. Pull off double relay, connect cable link between term.87b and term.30 into connection base. Electric fuel pump must run.

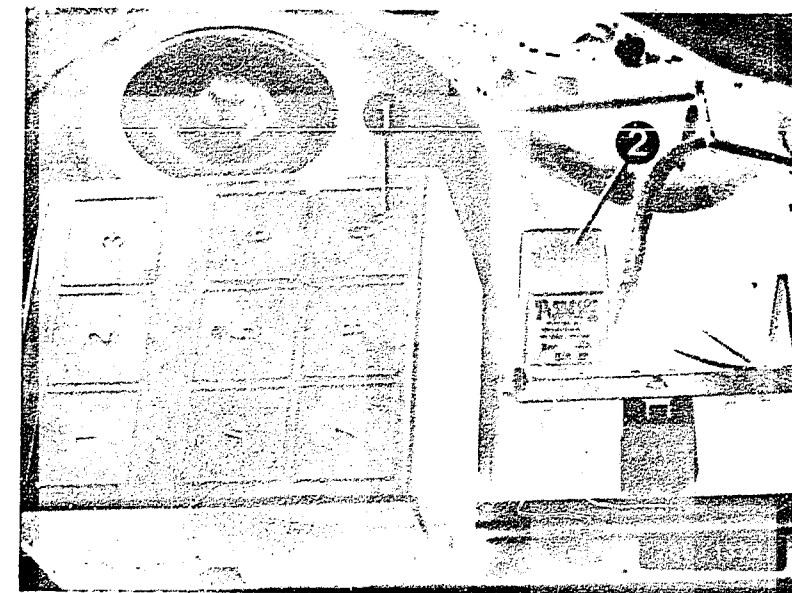
Further installation positions

*Connect the solenoid-operated injection valves between fuel-distribution pipe and intake manifold.

*The central ground is secured on the right at the front on the valve housing. (Near to auxiliary-air device).

Components of fuel-supply system

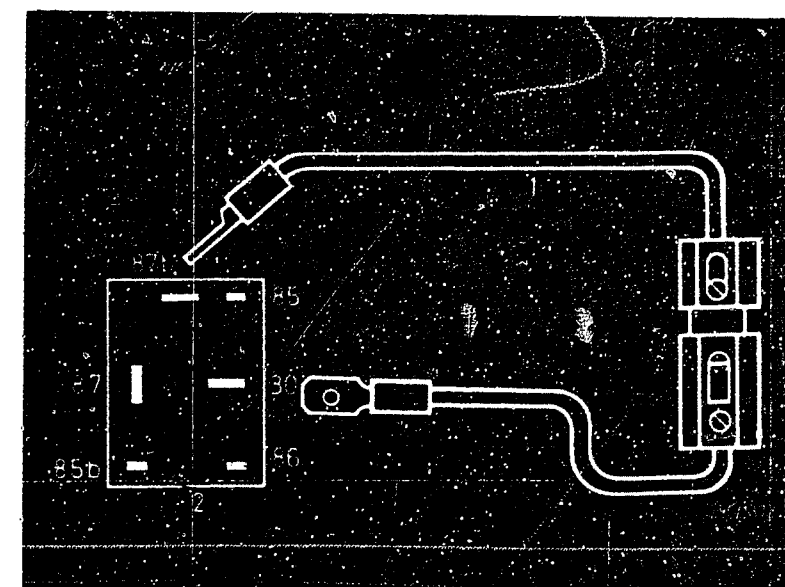
*Electric fuel pump, pressure damper and fuel filter are secured on the vehicle floor panel, on the right in front of the fuel tank.



1 = Covering
2 = Double relay

1 = Jumper with fuse holder and 10 A fuse (user-fabricated)

2 = Top view of connection base



USAGE, STRUCTURE

These brief instructions mainly comprise vehicle-specific special features and test specifications (set values).

The trouble-shooting chart leads the way to various causes/component faults in accordance with the customer complaint.
Detailed instructions on trouble-shooting are to be taken from the basic instructions via the trouble-shooting chart.

NOTE: Even if reference is made to basic instructions, the set values, terminal connections and special features in these vehicle-related brief instructions are always binding.

SAFETY AND PRECAUTIONARY MEASURES

Keep people clear of danger.
Avoid damage to the engine, trigger box and ignition system.

* WARNING !
Increased-power ignition system.
Dangerous high and low voltages.

Do not touch live parts or terminals;
danger in primary and secondary
circuits.

* For compression test, remove trigger-box
plug or connect ignition coil term. 4
firmly to ground with auxiliary
cable.

Note :
Suppression of auxiliary cable
min. 2 k Ω .

For further precautionary measures, see basic
instructions.

TROUBLE-SHOOTING CHART

Customer complaint (fault symptom)

1. Starting motor operates, but engine fails to start or starts only with difficulty.
2. Engine starts but then dies.
3. Rough idling (engine speed, exhaust gas).
4. Poor throttle response, flat spot during acceleration.
5. Misfiring (ignition, fuel injection).
6. Engine lacks power/ low maximum speed.
7. Fuel consumption too high.
8. Engine runs on.
9. Engine pings/knocks.
10. Engine becomes too hot.
11. Fault lamp.

| | | | | | | | | | | Cause (component fault) |
|---|--|---|---|---|--|--|--|--|---|--------------------------------|
| | | | | | | | | | * | Self-diagnosis |
| * | | * | * | * | | | | | | High-voltage side |
| * | | * | * | * | | | | | | Ignition coil |
| * | | | | | | | | | | Firing sequence |
| * | | | | | | | | | | Voltage, trigger box |
| * | | | | | | | | | | Voltage, primary circuit |
| * | | | | | | | | | | Voltage, EI-K control unit |
| * | | | | | | | | | | Engine-speed sensor |
| * | | | | | | | | | | Operation of EI-K control unit |
| * | | | | | | | | | | Engine-speed signal (Jetronic) |

TROUBLE-SHOOTING CHART

Customer complaint (fault symptom)

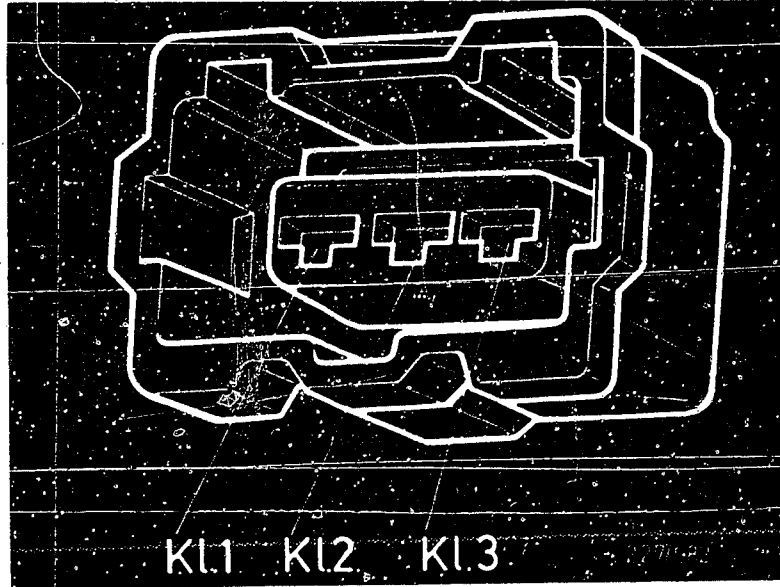
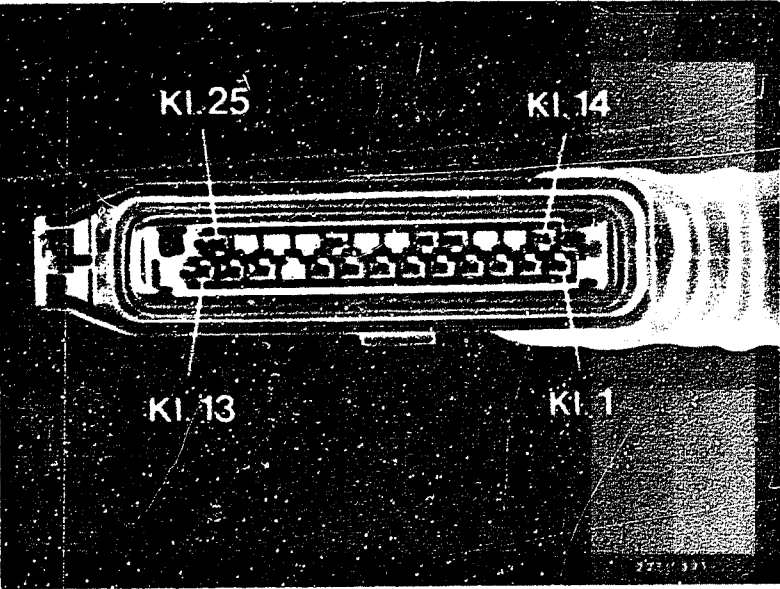
- Starting motor operates, but engine fails to start or starts only with difficulty.
- Engine starts but then dies.
- Rough idling (engine speed, exhaust gas).
- Poor throttle response, flat spot during acceleration.
- Misfiring (ignition, fuel injection).
- Engine lacks power/low maximum speed.
- Fuel consumption too high.
- Engine runs on.
- Engine pings/knocks.
- Engine becomes too hot.
- Fault lamp.

| Cause (component fault) | | | | | | | | | |
|-------------------------|---|---|---|---|---|--|---|---|-----------------------------------|
| * | | | * | | | | | | Contact resistances |
| | * | * | | * | * | | | | Throttle-valve switch - idle |
| | | | | * | | | * | | Throttle-valve switch - full load |
| | | | | | | | | * | Fault lamp |
| | * | * | | * | * | | * | * | Spark-advance angle |
| | | | * | | | | | | Voltage, EI-K control unit |
| | | | * | | | | | | Voltage, trigger box |
| | | | * | | | | | | Voltage, ignition coil |
| | | | * | | | | | | Primary voltage |

For production reasons:
continued on the following
coordinate.

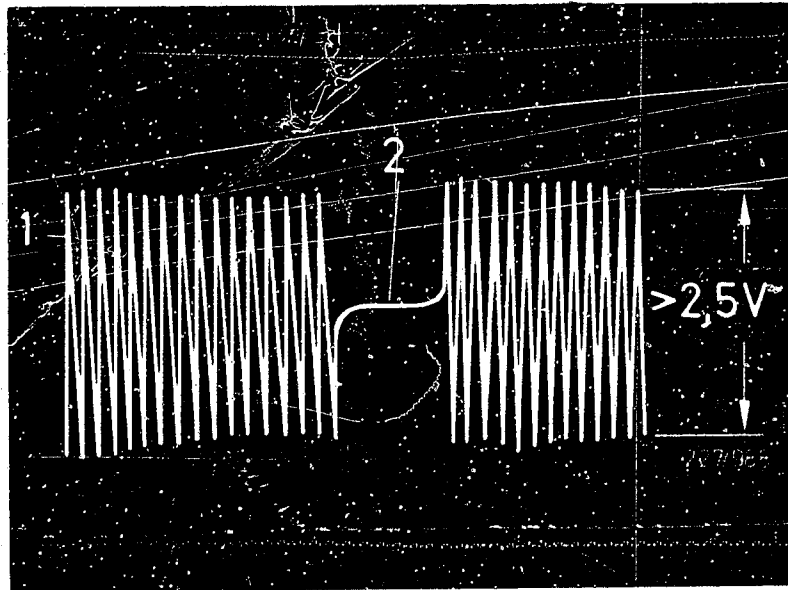
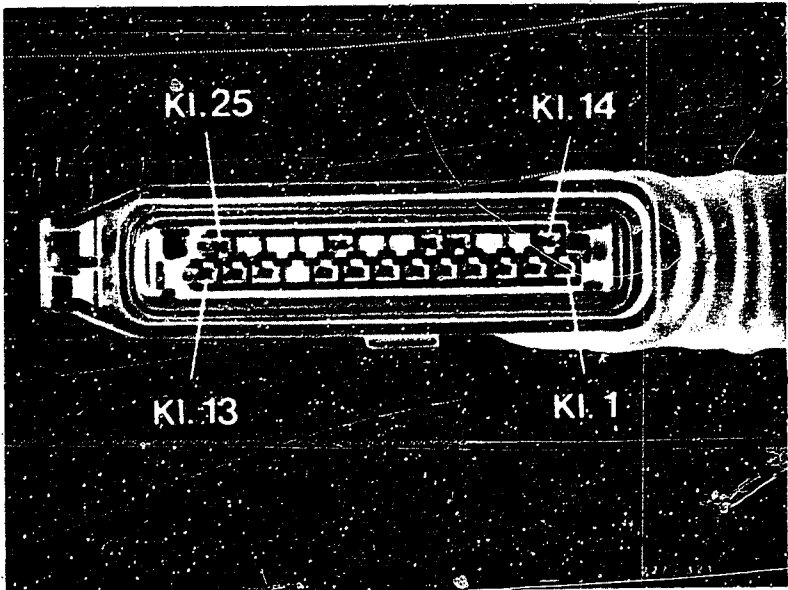
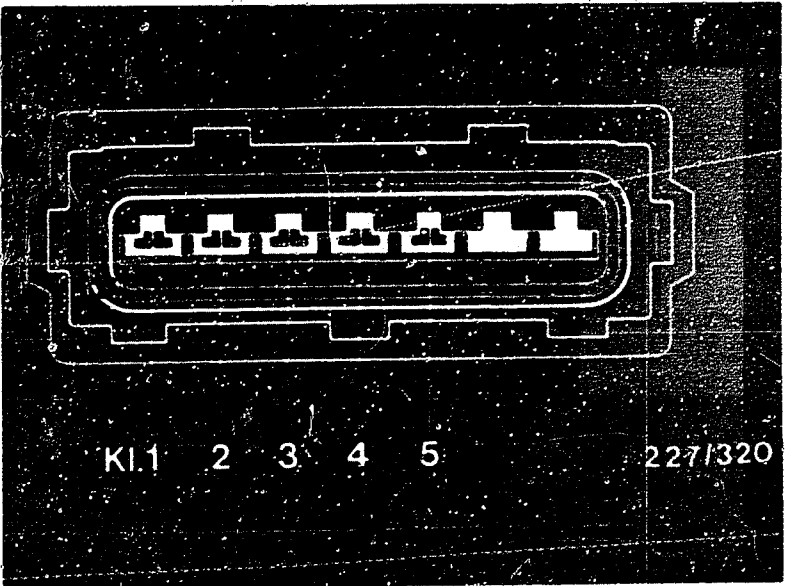
SELF-DIAGNOSIS TEST TABLE

| Fault ind. Flash code | Testing components/operation Test instructions/conditions | Terms. | Set values |
|--------------------------|--|--|--|
| 2 | Coolant-temperature sensor Resistance, EI-K control-unit plug at temperature + 20° C + 30° C + 80° C + 90° C + 100° C | 2 , 20 | 2,1...2,9 k Ω 1,4...2,0 k Ω 280...390 Ω 210...280 Ω 160...210 Ω |
| 4 | Knock sensor defective 1. Check both knock-sensor plug connections for oxidation. 2. Resistance, EI-K control-unit plug and left-hand knock-sensor plug connection (cyl. 1,2,3) 3. Resistance, EI-K control-unit plug and right-hand knock-sensor plug connection (cyl. 4,5,6) 4. Resistance, EI-K control-unit plug | 13 , 1 12 , 2 25 , 1 24 , 2 25 , 24 13 , 12 | approx. 0 Ω approx. 0 Ω approx. 0 Ω approx. 0 Ω infinite Ω infinite Ω |
| 5 | LH-Jetronic load signal Resistance, EI-K control-unit plug and LH-Jetronic control-unit plug Voltage, EI-K control-unit plug with handle cover removed | 8 , 24 8 , 20 (+) (-) | approx. 0 Ω 0,1...1,0 V |
| 6 | Cylinder recognition pickup Resistance, EI-K control-unit plug Resistance, EI-K control-unit plug | 18 , 19 19 , 21 | approx. 0 Ω infinite Ω |



RAPID DIAGNOSIS CHART

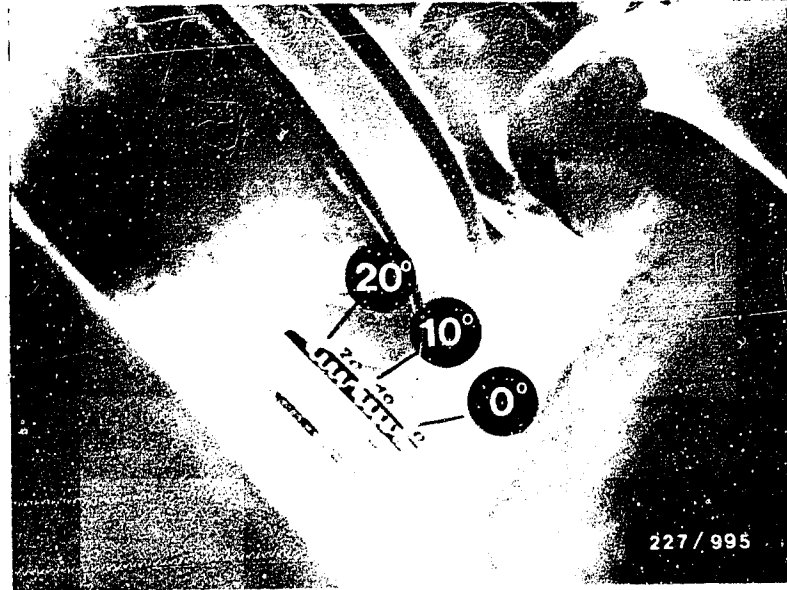
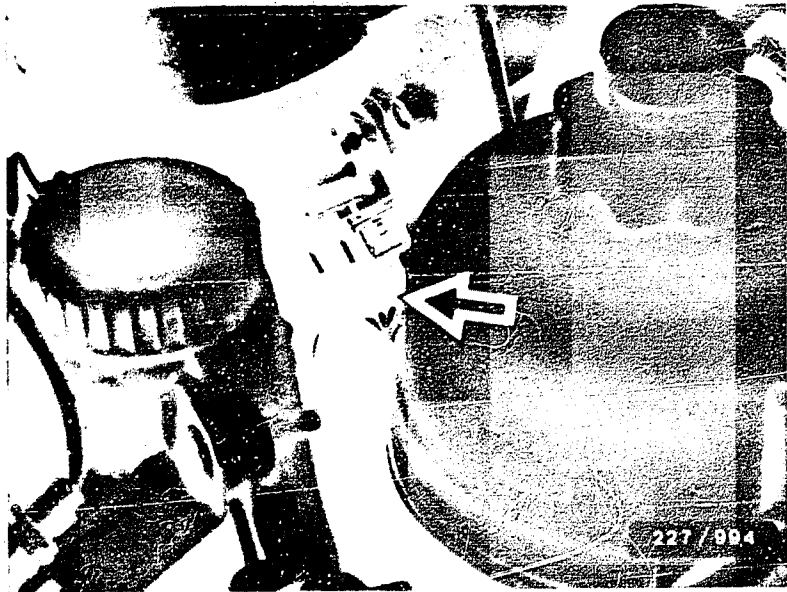
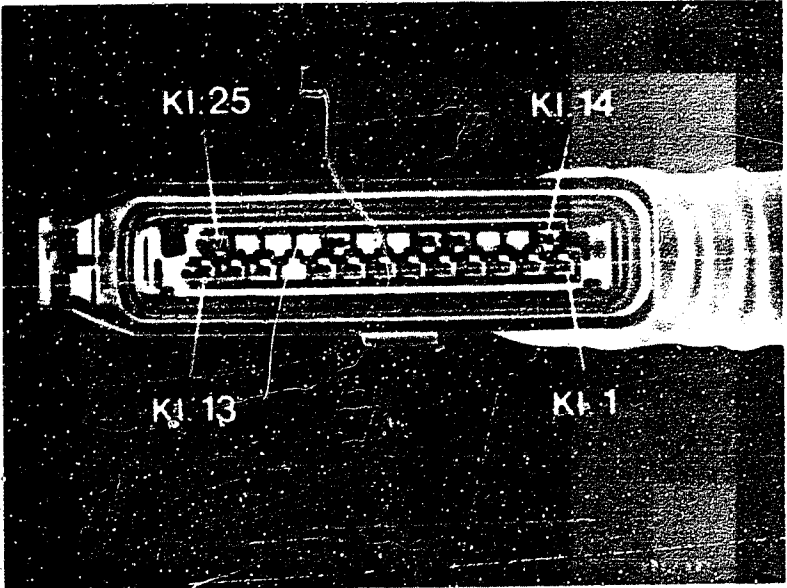
| Test step | Testing components/operation Test instructions/conditions | Terms. | Set values |
|-----------|--|------------------------------------|--|
| 1 | HIGH-VOLTAGE SIDE visual examination (distributor cap, ignition wiring etc.) Ignition oscilloscope pattern | — | — |
| 2 | IGNITION COIL visual examination, plug in place, sealing compound escaped? Resistance, primary Resistance, secondary | 1 15 1 4 | 0,6...1,0 Ω 6,4...11,1 k Ω |
| 3 | POWER SUPPLY, TRIGGER BOX Ignition ON. Voltage, trigger-box plug | 4 2 + — | approx. U _B |
| 4 | PRIMARY CIRCUIT Ignition ON. Voltage, trigger-box plug | 1 2 + — | approx. U _B |
| 5 | POWER SUPPLY, EI-K CONTROL UNIT Ignition ON. Voltage, EI-K control-unit plug | 6 20 + — | approx. U _B |
| 6 | ENGINE-SPEED SENSOR 1. Resistance, EI-K control-unit plug 2. Resistance, EI-K control-unit plug 3. Start engine. Signal EI-K control-unit plug | 10 23 11 23 10 23 — + | 445...790 Ω infinite Ω For signal, see bottom picture. |
| 7 | EI-K CONTROL UNIT, OPERATION Start engine. Measuring signal, trigger-box plug and negative terminal of battery | 16 B— + — | Rectangular pulses |
| 8 | ENGINE-SPEED SIGNAL Start engine. Measuring signal, LH-Jetronic control-unit plug and negative terminal of battery | 1 B— + — | Rectangular pulses |



RAPID DIAGNOSIS CHART (continued)

| Test step | Testing components/operation Test instructions/conditions | Terms. | Set values |
|-----------|---|--------------|--|
| 9* | CONTACT RESISTANCES Check contact resistance of power-supply lines from trigger box/primary circuit. | — | max. 0.3 Ω |
| 10 | THROTTLE-VALVE SWITCH, IDLE Resistance, EI-K control-unit plug Throttle-valve in idle position | 7 , 20 | approx. 0 Ω |
| 11 | THROTTLE-VALVE SWITCH, FULL LOAD Resistance, EI-K control-unit plug Throttle valve fully open | 4 , 20 | approx. 0 Ω |
| 12 | FAULT LAMP Ignition ON. Fault lamp must light up. Engine at idle. Fault lamp goes out or flashes. | — | Fault lamp flashing! Assess flash code |
| 13 | POWER SUPPLY, TRIGGER BOX Engine idle. Voltage, trigger-box plug with rubber sleeve pushed back (arrow, center picture). | 4 2 + - | 12...14 V, max. 1 V below U _B |
| 14 | POWER SUPPLY, EI-K CONTROL UNIT Engine idle. Voltage, EI-K control-unit plug with handle cover removed | 6 20 + - | 12...14 V, max. 1 V below U _B |
| 15 | POWER SUPPLY, IGNITION COIL Engine idle. Voltage, ignition coil and vehicle ground | 15 31 + - | min. 10 V |
| 16 | SPARK-ADVANCE ANGLE Engine at idle Spark-advance angle with EI-K con. unit ...121 Spark-advance angle with EI-K con. unit ...120 | — | 9...13° BTDC 15...19° BTDC |
| 17 | OUTPUT STAGE Ignition ON. Voltage, ignition coil | 15 1 + - | 0 V |
| 18 | PRIMARY VOLTAGE Voltage, ignition coil with engine at idle | 15 1 + - | 290...370 V |

* Only to be carried out when engine is not running.



TEST SPECIFICATIONS

Ignition coil, primary 0,6... 1,0 Ω
 Ignition coil, secondary 6,4...11,1 k Ω

Coolant-temperature sensor

Resistance at
 coolant temp-
 erature

| | |
|--------|----------------------|
| 20° C | 2,1...2,9 k Ω |
| 30° C | 1,4...2,0 k Ω |
| 80° C | 280...370 Ω |
| 90° C | 210...280 Ω |
| 100° C | 160...210 Ω |

Spark-advance angle at idle with

| | |
|-------------------------|---------------|
| EI-K control unit...121 | 9...13° BTDC |
| EI-K control-unit...120 | 15...19° BTDC |

Power supply

Trigger box with
 engine idling

12...14 V

Power supply

EI-K control unit with
 engine idling

12...14 V

Power supply

Ignition coil with
 engine idling

min. 10 V

Primary voltage

with engine idling

290...370 V

Engine-speed sensor

Insulation

> 1 M Ω

Internal resistance

445...790 Ω

Voltage

U_{pp} > 2,5 V

Knock-sensor

breakaway torque

15...25 Nm

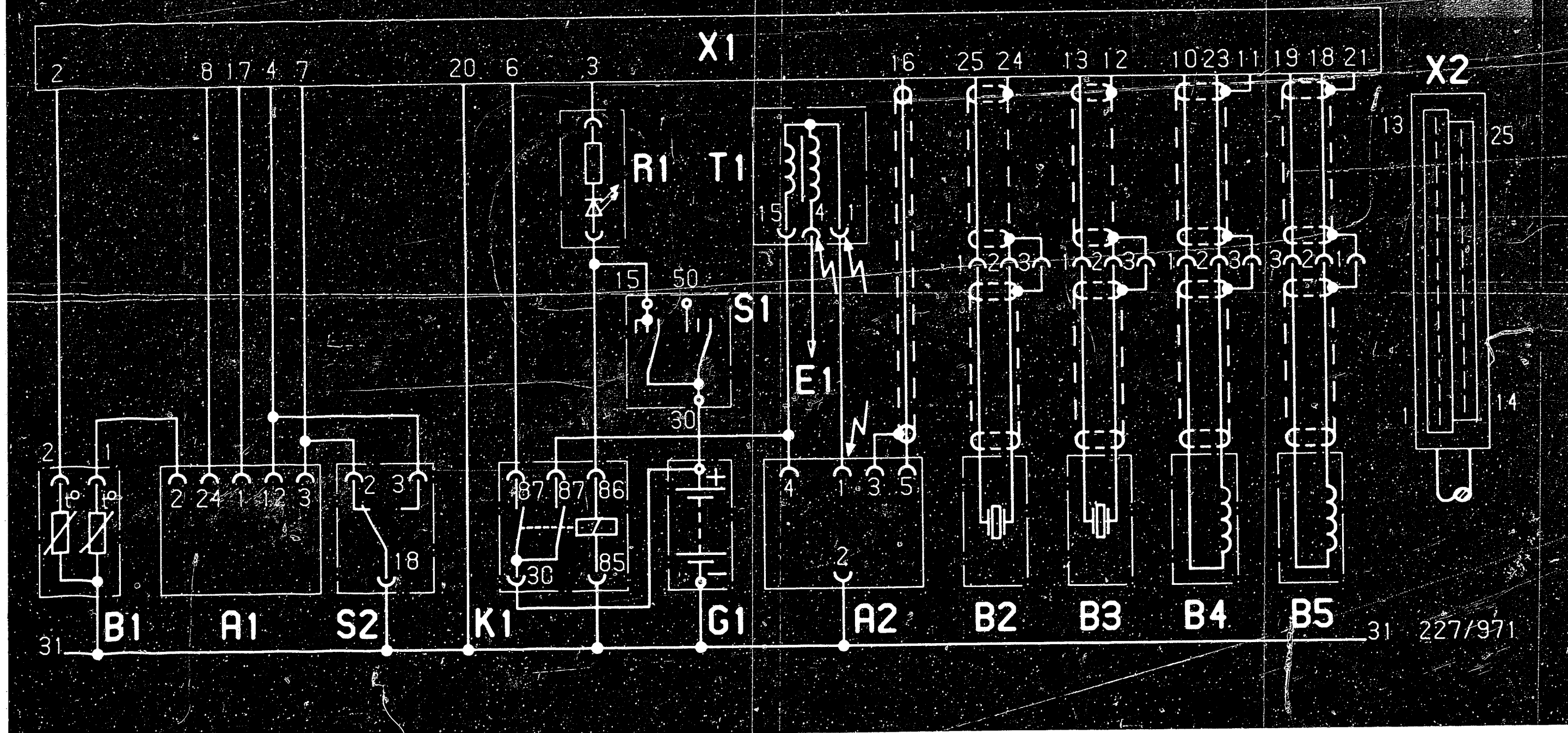
Pulse generator

Cyl.-1 recognition

approx. 0 Ω

For settings for exhaust gas etc., see LH-Jetronic
 microcard

For production reasons:
 continued on the following
 coordinate.



Danger arrows = dangerous voltages (400 V - 25 kV)

A1 = LH-Jetronic control unit

A2 = Trigger box

B1 = Temperature sensor, coolant

B2 = Knock sensor 2 (cylinders 4-5-6)

B3 = Knock sensor 1 (cylinders 1-2-3)

B4 = Engine-speed sensor

B5 = Induction pickup, cylinder 1

E1 = to high-voltage distributor

G1 = Battery

K1 = Power-supply relay

R1 = Fault lamp with protective resistor

S1 = Ignition and starting switch

S2 = Throttle-valve switch

T1 = Ignition coil

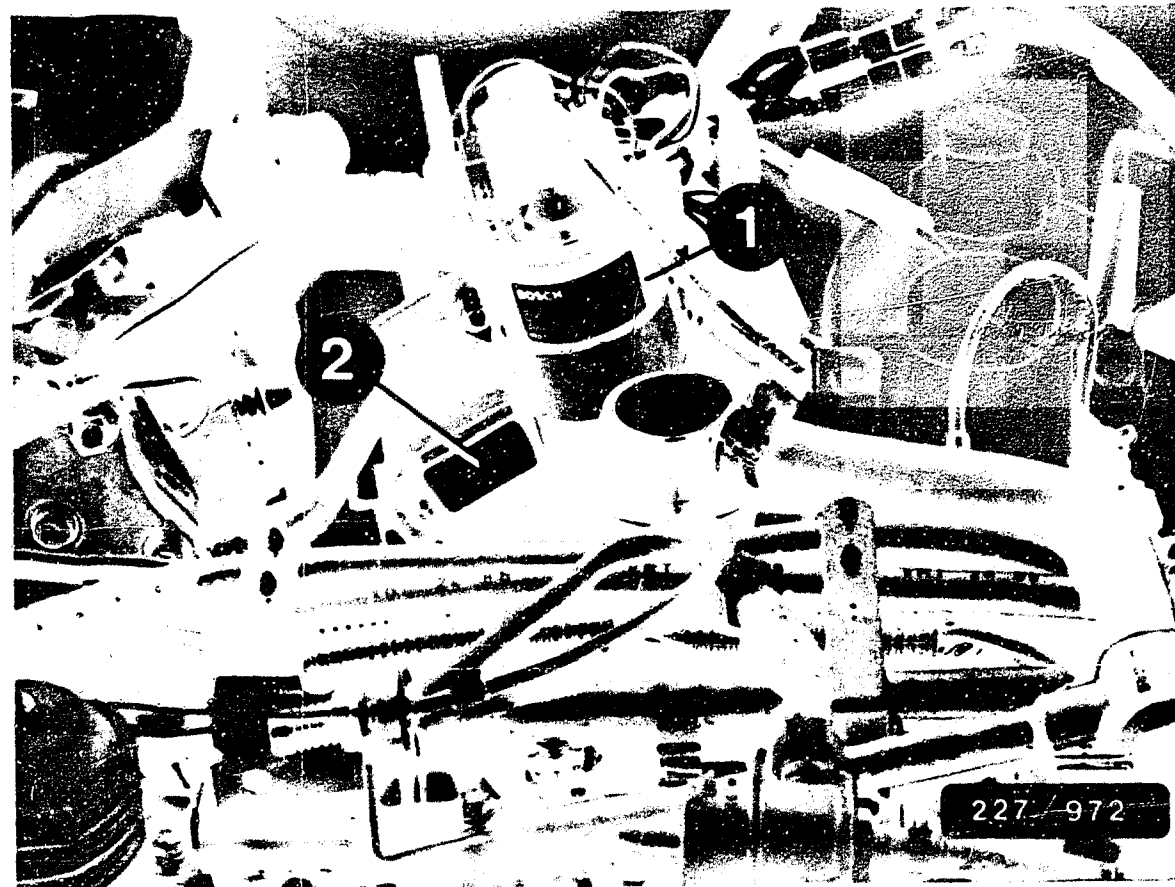
X1 = EI-K control-unit plug

X2 = EI-K control unit 1

ELECTRICAL TERMINAL DIAGRAM

E15

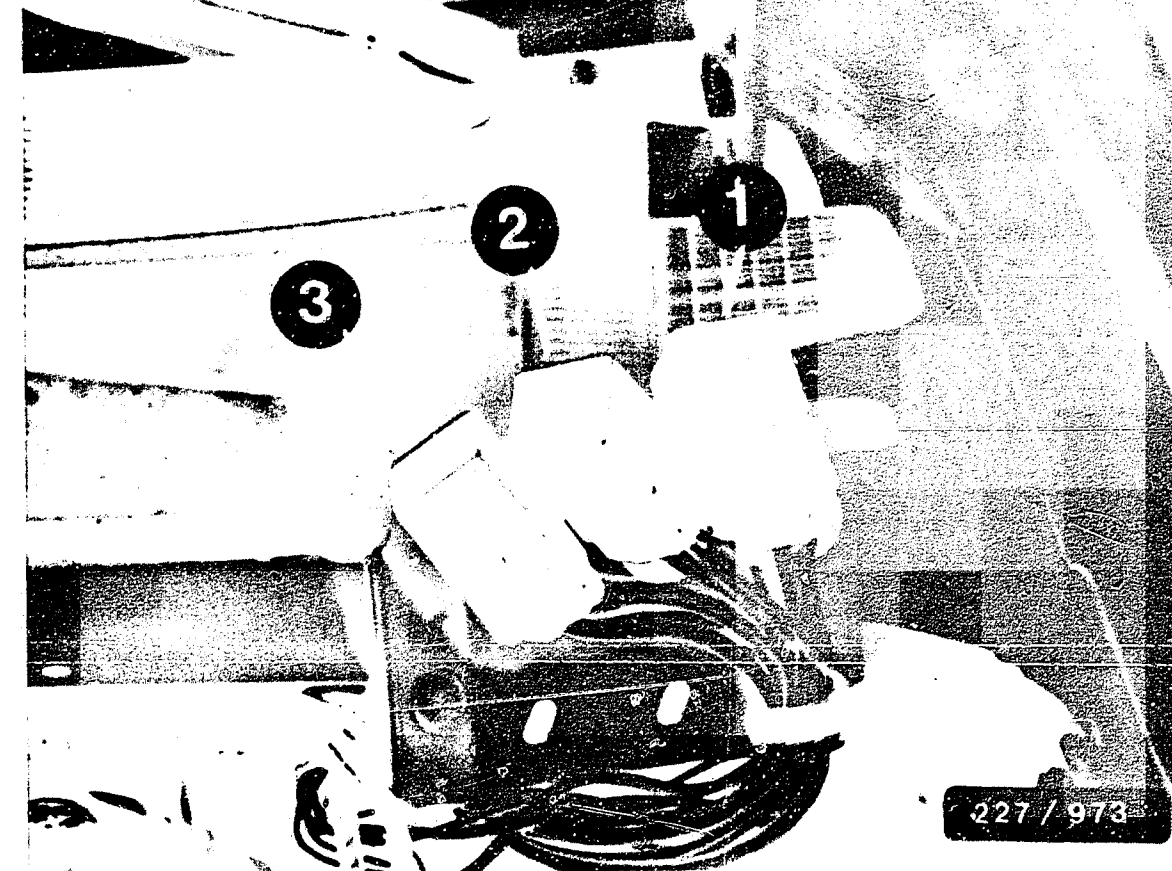
E16



- 1 = Ignition coil
- 2 = Trigger box with heat sink

INSTALLATION POSITION OF COMPONENTS

The trigger box and the ignition coil are mounted on a common heat sink and are accommodated in the engine compartment on the left-hand side as viewed in the forward direction of travel.



- 1 = Ignition power-supply relay
- 2 = LH-Jetronic main relay
- 3 = Fuel-pump relay

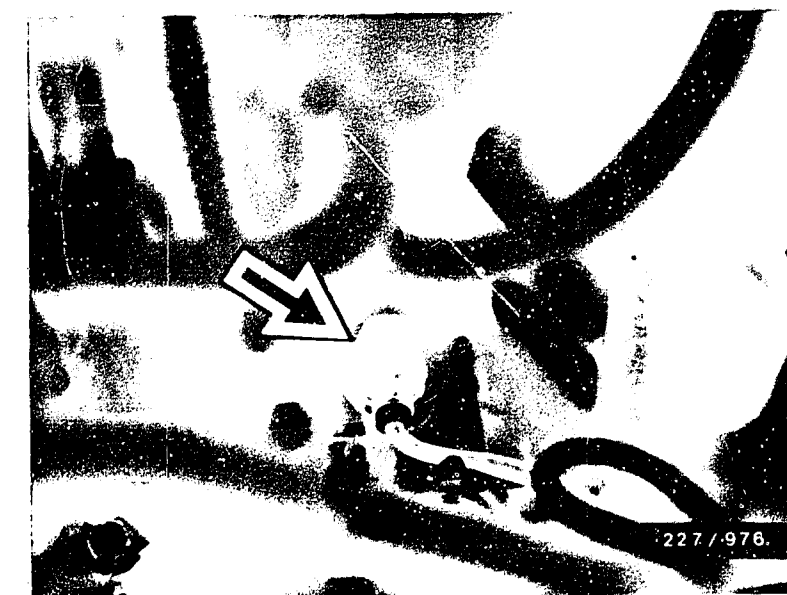
INSTALLATION POSITION OF COMPONENTS (continued)

INSTALLATION POSITION OF COMPONENTS (continued)

The pulse generator for cylinder-1 detection is slipped onto the ignition cable of cylinder 1, see arrow in top picture.

The coolant-temperature sensor is on the engine at the front, on the thermostat housing, see arrow in center picture.

The engine-speed sensor is on the engine at the rear, on the clutch housing, see arrow in bottom picture.



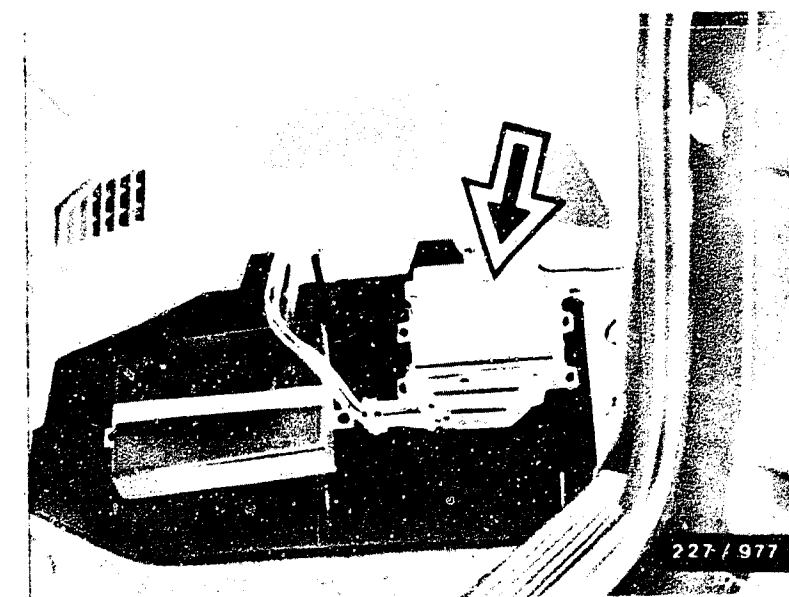
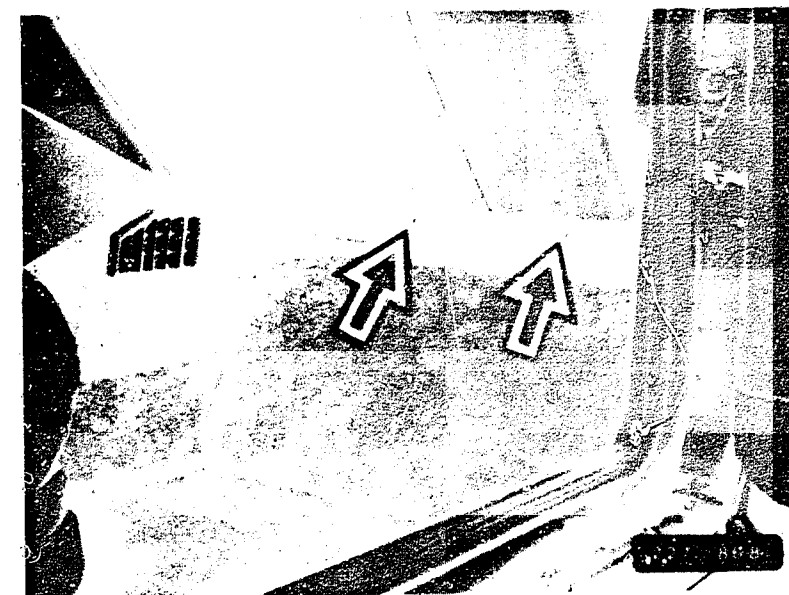
INSTALLATION POSITION OF COMPONENTS (continued)

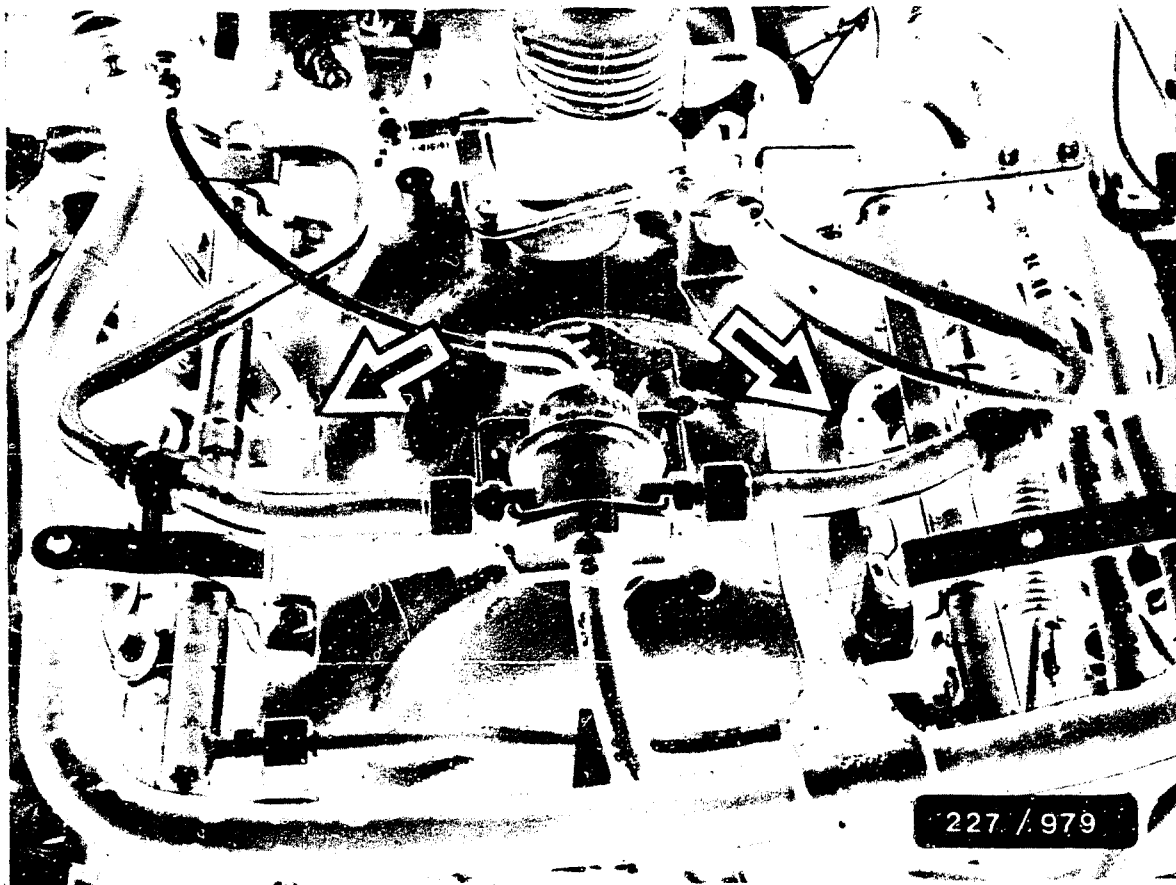
The EZ-K control unit is in the front-passenger footwell under a floor plate, see arrow in center picture.

How to remove:

Loosen two nuts on the upper edge of the floor plate and take off floor plate, see arrows in top picture.

The LH-Jetronic control unit is behind the glove box, see arrow in bottom picture.





Arrows = knock-sensor plug-in connections

The knock sensors are under the intake manifold on the engine block (not visible in picture).

How to remove:
Remove fuel lines, electric leads, injection valves and intake manifold.

Mount fastening screw of knock sensor without washer, spring lock washer, tooth lock washer etc.

Tightening torque 15 ... 25 Nm

Lock fastening screw with locking paint only.

For production reasons:
continued on the following
coordinate.

INSTALLATION POSITION OF COMPONENTS (continued)

Fault Lamp (1) including protective resistor are in the instrument panel (top picture).

How to remove:

Remove steering wheel (wheels straight ahead).

Introduce thin screwdriver consecutively into the two holes in the instrument panel (top picture, arrows).

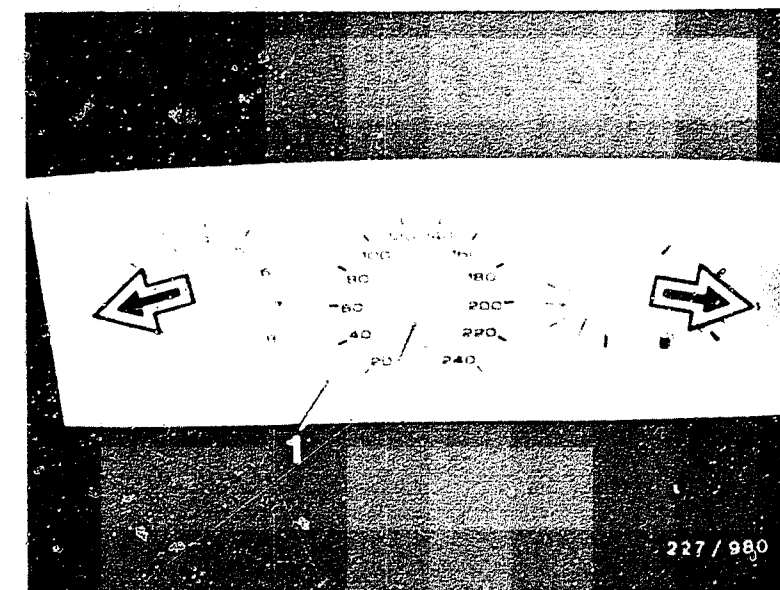
Instrument panel is unlatched by pressing lightly on the screwdrivers.

Pull instrument panel out of installation opening (speedometer shaft has latching connection).

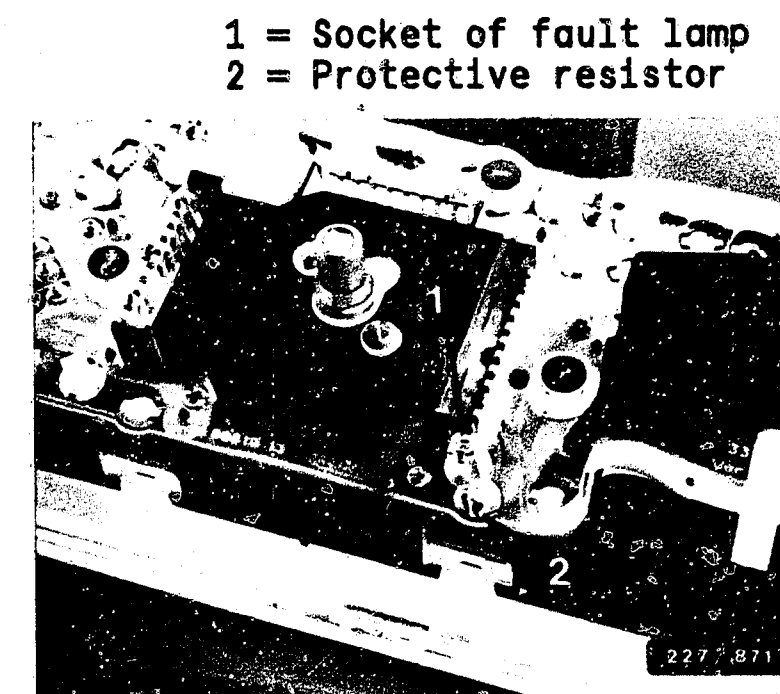
Remove socket of fault lamp (1) (see bottom picture).

Installation of fault lamp:

Marked by a large recess on the lower part of the printed-circuit board for leading through the protective resistor (2) (see bottom picture).



1 = Fault lamp



1 = Socket of fault lamp
2 = Protective resistor

Trouble-shooting instructions : BMW5004
BOSCH system : Motronic M 1.1
Make of vehicle : BMW
Basic microcard : PKW-052

TABLE OF CONTENTS

| Section | Coordinates |
|--|-------------|
| Special features..... | 02 |
| Structure, usage, safety and precautionary measures..... | 07 |
| Trouble-shooting chart..... | 08 |
| Self-diagnosis test table..... | 09 |
| Test specifications..... | 15 |
| Electrical terminal diagram..... | 19 |
| Installation position of components, notes on removal and installation..... | 23 |

SPECIAL FEATURES

These trouble-shooting instructions apply to the following vehicle models, valid at the time of compilation:

- * BMW 735i with 3.5 l / 6 cyl. as of 10.86
- BMW 730i with 3.0 l / 6 cyl. as of 1.87

*Motronic M 1.1 system with self-diagnosis and flash-code output.

*Control unit with variant coding.
Important! When ordering, take note of detailed description (see below).

*Control unit has 55-pin plug.

*Common sensor for engine speed and reference mark.

*Grouped fuel injection: subdivision into 2 groups with time-staggered injection.
Group 1: cylinders 1,3,5
Group 2: cylinders 2,4,6.
Identification via sensor on h.v. cable, cylinder 6.

*Lambda closed-loop control and tank ventilation with cycled valve (if fitted).

STRUCTURE, USAGE

These brief instructions essentially comprise vehicle-specific special features and test specifications (set values).
The trouble-shooting chart guides you to various causes/component faults in accordance with the customer complaint. Detailed instructions on trouble-shooting are to be taken from the basic instructions, via the trouble-shooting chart.

NOTE: Even if reference is made to basic instructions, the set values, terminal assignments and special features of these vehicle-related brief instructions are always binding.

Holding circuit for tank vent valve.

As of 12.86, Motronic control units are fitted with a holding circuit for the tank vent valve in the 735i. The holding circuit is always installed, without being allocated to vehicles with or without catalytic converter.

The holding circuit has the effect that the main relay remains pulled in for approx. 3 seconds after stopping the engine. In this way, the tank vent valve is closed via the control unit, preventing the engine from running on.

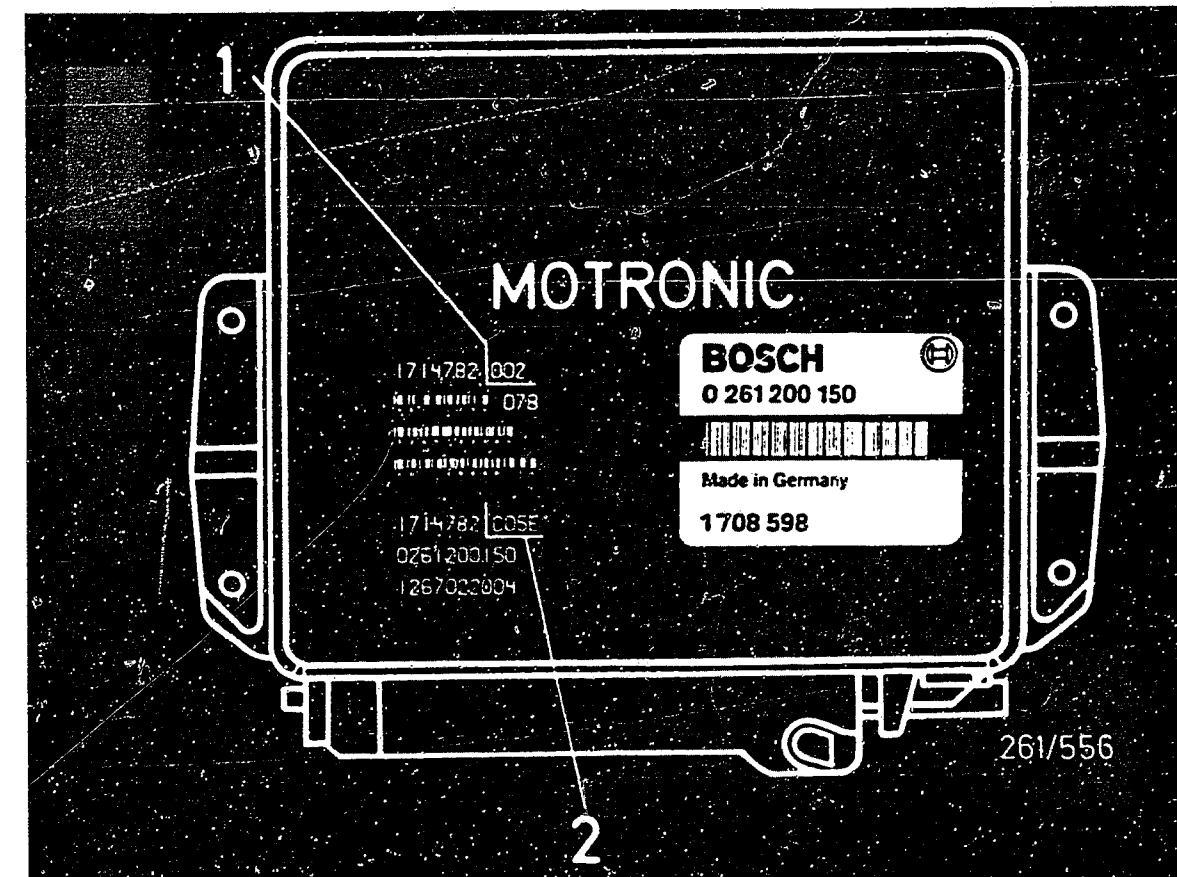
BMW initially introduced a new wiring harness with an additional adapter to implement the holding circuit.

The additional adapter (BMW No.1 718 200) provides the necessary connections to the control unit, main relay and term.15. As of 1.87, the holding circuit is integrated in the wiring harness, i.e. the additional adapter is dropped.

Operation of Motronic control units up to FD 651 with the new wiring harness is possible by removing the additional adapter and inter-connecting plugs B and C. Plug A remains open.
Plug A = 2-pin to control unit terms.27 and 36
Plug B = 3-pin pin housing
Plug C = 3-pin socket housing

Motronic control units as of FD 652 with the holding function can be operated on the wiring harness without the additional adapter by establishing a connection between control unit term.27 and ignition coil term.15 (see terminal diagrams). However, the holding function is not activated.

Note: fit revised coding plug in instrument cluster.



Control unit 0 261 200 150, old version
FD 645 to 651.

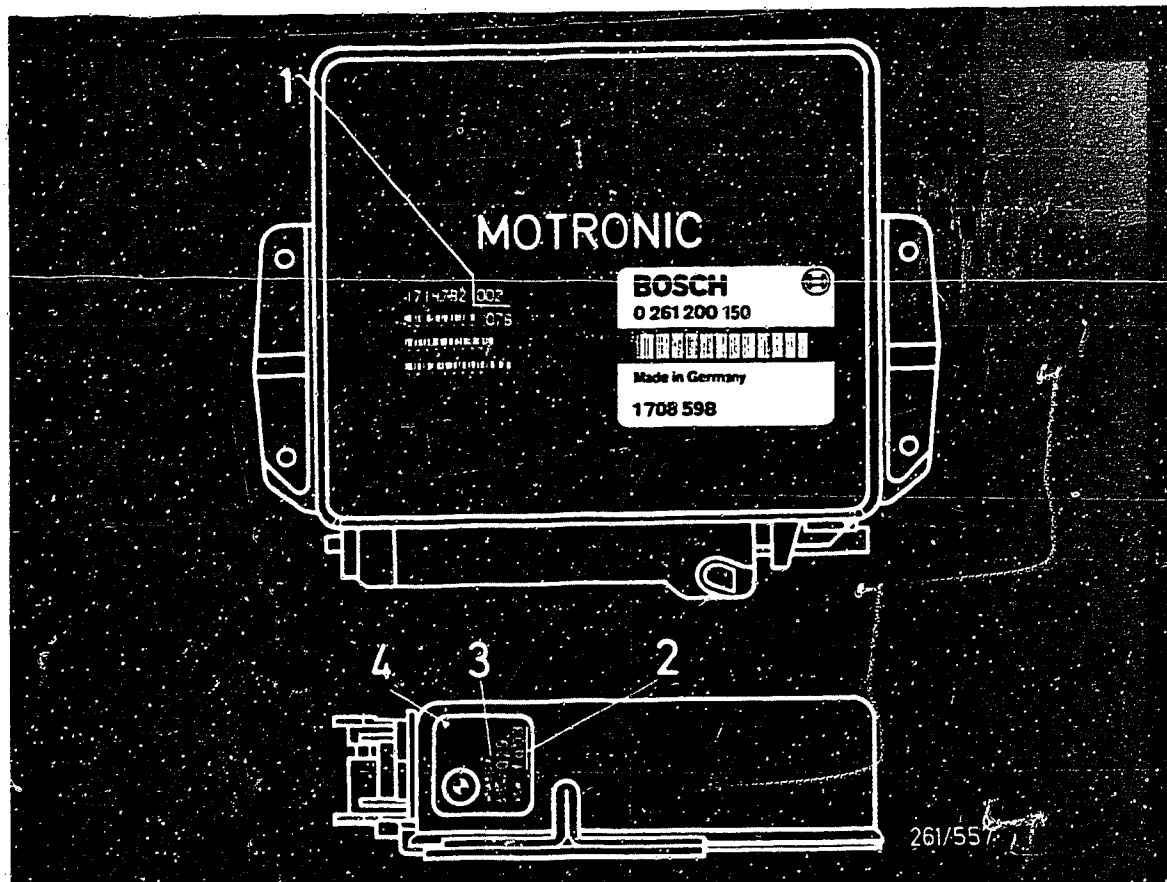
1 = Growth number, 3-digit
2 = Variant control word, 4-position,
alphanumeric

Variant-coded Motronic control units

When the new BMW 7 Series was introduced as of 10.86, a new type of control unit also entered series production.

The desired variant must be activated in a basic control unit in order to be able to adapt the engines to various types of transmission, to the model series, to different national versions and to differing fuel qualities and other special versions.

The object of this is to reduce the number of types of control unit.



Control units, new version as of FD 652

- 1 = Growth number, 3-digit
- 2 = Variant control word, 4-position, alphanumeric
- 3 = Chassis number
- 4 = BMW sticker

The new control-unit type must be programmed for the specific vehicle type **b e f o r e** delivery to the BG/BD at KH.

Note: the engine will not run with uncoded control units. Damage to the engine may occur with incorrectly coded control units.

Coding and programming can be carried out at KH only.

To do this, KH requires the 10-digit part number for the basic control unit plus further information which is to be taken from the installed control unit.

The following information must be given when ordering:

1. Part number, 10-digit as before
2. Growth number, 3-digit (001 to 999)
3. Variant control word, 4-position, alphanumeric.

Example: 1. 0 261 200 150
2. 002
3. C05E

Delivery procedure:

+The variant-coded control units are carried at KH as central stock parts.

+Delivery by overnight despatch (within the Federal Republic of Germany) directly to the orderer.

+Delivery is extended by one day due to the necessary programming of the control units at KH.

SAFETY AND PRECAUTIONARY MEASURES

Keep people away from danger.
Avoid damage to engine, control unit
and ignition system.

* W A R N I N G !
High energy ignition system.
Dangerous high and low voltages.

Do not touch live parts or terminals.
Danger from primary and secondary
circuits. This applies to e.g. control
unit, high-voltage distributor, at the
ignition coil.

* Avoid injection and high-voltage
flashovers during the compression
test. For this reason, pull out
main relay.

See basic instructions for further
precautionary measures.

|| = System-specific

TROUBLE-SHOOTING CHART

Customer complaints (symptoms of trouble)

1. Starting motor operates, engine fails to start
or starts only with difficulty.
2. Engine starts but
but then dies.
3. Rough idling
(engine speed, exhaust gas).
4. Poor throttle response,
flat spot during acceleration.
5. Engine misfiring
(ignition, fuel injection).
6. Maximum engine power/ top
speed not reached.
7. Fuel consumption too high.
8. Engine running on (dieseling).
9. Engine pinging/knocking.
10. Engine overheating.
11. Fault lamp.

| Cause (component fault) | | | | | | | | | | | |
|-------------------------|---|---|---|---|---|---|---|---|---|---|------------------------------------|
| * | * | * | * | * | * | * | * | * | * | * | Self-diagnosis |
| * | | | | | | | | | | | Voltage at control unit |
| * | | | | | | | | | | | Engine-speed/reference mark sensor |
| * | | * | | | * | * | | | | | Fuel pressure |
| * | | * | | | | * | * | | | | Solenoid-operated injection valves |
| | | * | * | | * | | | | | | Throttle-valve switch |
| | | * | * | * | * | * | * | | | | Air-flow sensor |
| | | * | * | * | | | | | | | Idle actuator |
| * | * | * | * | | | | | | | | Air-intake system |
| | | * | | | | | | | | | Idle speed, CO |
| * | | * | | * | * | | | | | | Ignition coil |
| * | | * | * | * | * | | | | | | Primary signal |
| | | * | * | * | * | * | | | | | Secondary pattern |
| * | * | * | * | | * | * | | * | * | | Ignition point |
| * | | | | * | | | | | | | High-voltage sensor |
| | | * | | | | | | | | | Overrun cut-off |
| | | * | * | * | | | | | | | Interference-suppression resistors |
| | | * | * | * | | | | | | | Noise test |
| | | | | | * | | | | | | Interference |
| | | | | | * | | | | | | Throttle valve |
| | | | | | * | | | | | | Fuel delivery |
| | * | * | * | | | | * | | | | Tank vent |
| | | * | * | | | | | | | | Lambda closed-loop control |
| * | * | * | * | * | * | * | * | * | * | * | Control unit |

SELF-DIAGNOSIS TEST TABLE

| Fault indication Flashing code | Testing of component/function | Test instructions/ Test conditions | Terminals | Set values |
|-----------------------------------|---|--|-----------|-------------------------------------|
| 1 2 1 1 | Control unit (memory contents) | Control unit defective. | | — |
| 1 2 1 5 | Air-flow sensor | Check lead to term. 7 for open circuit, short circuit to ground or to positive (5V or batt. +ve) and for contact with term. 12 and term. 26. Check leads to term. 12 and term. 26 for open circuit. Check resistors of air-flow sensor: between term.26 and term.7 (def. air-fl. sens. flap): between term. 26 and term. 12: | 7,12,26 | — 8...2500 Ω 500...1100 Ω |
| 1 2 2 1 | Lambda sensor | Lead to lambda sensor open-circuited, short-circuited to ground or battery voltage. Watch for damage to cable insulation. Sensor heater defective. Sensor clogged. | 28 | — |
| 1 2 2 2 | Lambda closed-loop control to rich or lean stop | Check CO content: Check induction system for leaks. Check fuel pressure: Injection valves defective. | | 0,5...1,5 % by vol. |
| 1 2 2 3 | Coolant-temperature sensor | Check temperature sensor and lead for open circuit and short circuit to ground. Temperature-sensor resistance: at +15...+30°C : at approx. +80°C : | 45 | — 0,2...1,2 Ω 2,8...3,2 Ω |

SELF-DIAGNOSIS TEST TABLE (CONTINUED)

| Fault indication Flashing code | Testing of component/function | Test instructions / Test conditions | Terminals | Set values |
|-----------------------------------|--|---|-----------------|---|
| 1 2 2 4 | Air-intake temperature sensor | Check temperature sensor and lead for open circuit and short circuit to ground. Temperature-sensor resistance at +15° C... +30°C: | 44 | —— 1450...3300 Ω |
| 1 2 3 1 | Supply voltage for control unit with engine running | Supply voltage too low: Check voltage drops at positive and ground terminals. Charge battery. Supply voltage too high : Check alternator regulator. | 37(+), 19(-) | Greater than 10 V Less than 16 V |
| 1 2 3 2 | Throttle-valve switch/ idle contact | Fault: idle contact constantly closed. Idle contact closed in inoperated position: Slightly actuate throttle valve : | 52 | 0 Ω Infinity Ω |
| 1 2 3 3 | Throttle-valve switch/ full-load contact | Fault: full-load contact constantly closed. Full-load contact closed in full-throttle position: Ease off accelerator pedal slightly. | 53 | 0 Ω Infinity Ω |
| 1 2 5 1 | Injection valves 1+3+5 and control unit (injection output stage) | Fault: short circuit to ground, to batt. +ve or open circuit in common positive or negative lead. Check lead and valves 1+3+5 for short circuit and open circuit; if O.K., control unit defective. | 16 | 4,8...5,7 Ω (3 valves in parallel) 14,5...17 Ω (1 injection valve) |

SELF-DIAGNOSIS TEST TABLE (CONTINUED)

| Fault indication Flashing code | Testing of component/function | Test instructions / Test conditions | Terminals | Set values |
|-----------------------------------|---|---|-----------|---|
| 1 2 5 2 | Injection valves 2+4+6 and control unit (injection output stage) | Fault: short circuit to ground, to batt. +ve or open circuit in common positive or negative lead. Check lead and valves 2+4+6 for short circuit and open circuit; if O.K., control unit defective. | 17 | 4,8...5,7 Ω (3 valves in parallel) 14,5...17 Ω (1 injection valve) |
| 1 2 6 2 | Idle actuator and control unit (output stage) | Fault: short circuit to ground or to batt. +ve. Check leads for contact with ground or batt. +ve; if O.K., control unit defective. Winding resistances at +15...+30°C: between terminal 1 and 2 : between terminal 3 und 4 : | 4, 22 | 19...25 Ω 17...22,5 Ω |
| 1 2 6 3 | Tank-ventilation valve and control unit (output stage) Note: CAT models only | Fault: short circuit to ground or to batt. +ve. Check lead for contact with ground or batt. +ve; if O.K., control unit defective. Winding resistance at +15...+30°C: | 5 | 35...55 Ω |
| 1 2 7 8 * | Transmission action | Fault: short circuit to ground. Check lead for short circuit to ground, or corresponding output in transmission control unit defective. | 51 | — |
| 1 2 8 8 | Fault lamp and control unit (lamp output stage) | Fault: short circuit to ground or to batt. +ve. | 15 | |

* = Applies to vehicles with electronic transmission control

TEST SPECIFICATIONS

| | |
|----------------------|-----------------------------------|
| Pressure regulator | |
| Fuel pressure | 2,8...3,2 bar |
| Electric fuel pump | |
| Delivery | |
| (measured in return) | at least 950 cm ³ /30s |
| Supply voltage | |
| (under load): | at least 12 V |

| | |
|--------------------------------|---------------|
| Air-intake temperature sensor | |
| Internal electrical resistance | |
| measured in air-flow sensor | |
| between term. 1 and term. 4 | |
| at ambient temperature | |
| (+15°C...+30°C): | 1450...3300 Ω |

| | |
|---|---------------|
| Coolant-temperature sensor | |
| Color of plug, blue. Internal | |
| electrical resistance | |
| at ambient temperature | |
| (+ 15° C...+ 30° C): | 1450...3300 Ω |
| with engine at normal operating temperature | |
| (approx. +80°C): | 280...360 Ω |

| | |
|-----------------------------------|-------------|
| Solenoid-operated injection valve | |
| Internal electrical resistance | |
| at ambient temperature | |
| (+ 15° C...+ 30° C): | 14,5...17 Ω |

| | |
|---|----------------|
| Air-flow sensor | |
| Internal electrical resistance between: | |
| term. 2 and term. 4: | 8...2500 Ω (*) |
| term. 3 and term. 4: | 500...1100 Ω |

(*) Slowly deflect the air-flow sensor flap as far as it will go. Resistance fluctuates between the terminal points of the potentiometer.

TEST SPECIFICATIONS (CONTINUED)

| | |
|--|-------------|
| Engine-speed and reference-mark sensor | |
| Internal electrical resistance | |
| between term. 1 and term. 2 at | |
| ambient temperature (+15°C...+30°C): | 400...800 Ω |
| Air gap: | 0,8±0,5 mm |

| | |
|----------------------------------|-----|
| Throttle-valve switch | |
| Resistance value of idle contact | |
| (term. 2 and term. 18): | 0 Ω |
| Resistance value of full-load | |
| contact (term. 3 and term. 18): | 0 Ω |

| | |
|--------------------------------|-------------|
| Idle actuator | |
| Internal electrical resistance | |
| at +15°...+30°C between | |
| term. 1 and term. 2: | 19...25 Ω |
| term. 3 and term. 2: | 17...22,5 Ω |

| | |
|-------------------------------------|----------|
| Lambda sensor | |
| Resistance value of heater winding: | 1...15 Ω |

| | |
|-----------------------|---------------|
| Ignition coil | |
| Primary resistance: | approx. 0 Ω |
| Secondary resistance: | 5000...7200 Ω |

| | |
|-------------------------------------|-------|
| Interference-suppression resistors | |
| High-voltage-distributor rotor: | 1 k Ω |
| High-voltage-distributor dome: each | 1 k Ω |
| Spark-plug connector: each | 5 k Ω |
| Spark plugs: | 5 k Ω |
| Ignition coil: | 1 k Ω |

TEST SPECIFICATIONS (CONTINUED)

High-voltage sensor:

Internal electrical resistance

between term. 1 and term. 2: approx. 0 Ω

Tank-ventilation valve:

(only in vehicles with catalytic converter)

Internal electrical resistance at

ambient temperature (+15°C...+30°C): 35...55 Ω

Idle test:

Engine at normal operating temperature,
switch off loads.

Idle speed: 800 \pm 40 min⁻¹

Spark-advance angle: 10 \pm 5°
crankshaft

(Automatic transmission to N or P)

CO content: without catalytic converter: 0,5...1,5 % CO by
vol.

Adjust mixture at the bypass screw

in the air-flow sensor:

turning to the left makes mixture leaner,

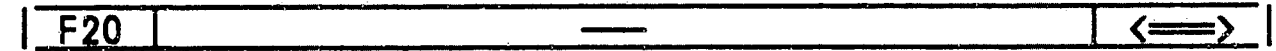
turning to the right makes mixture richer.

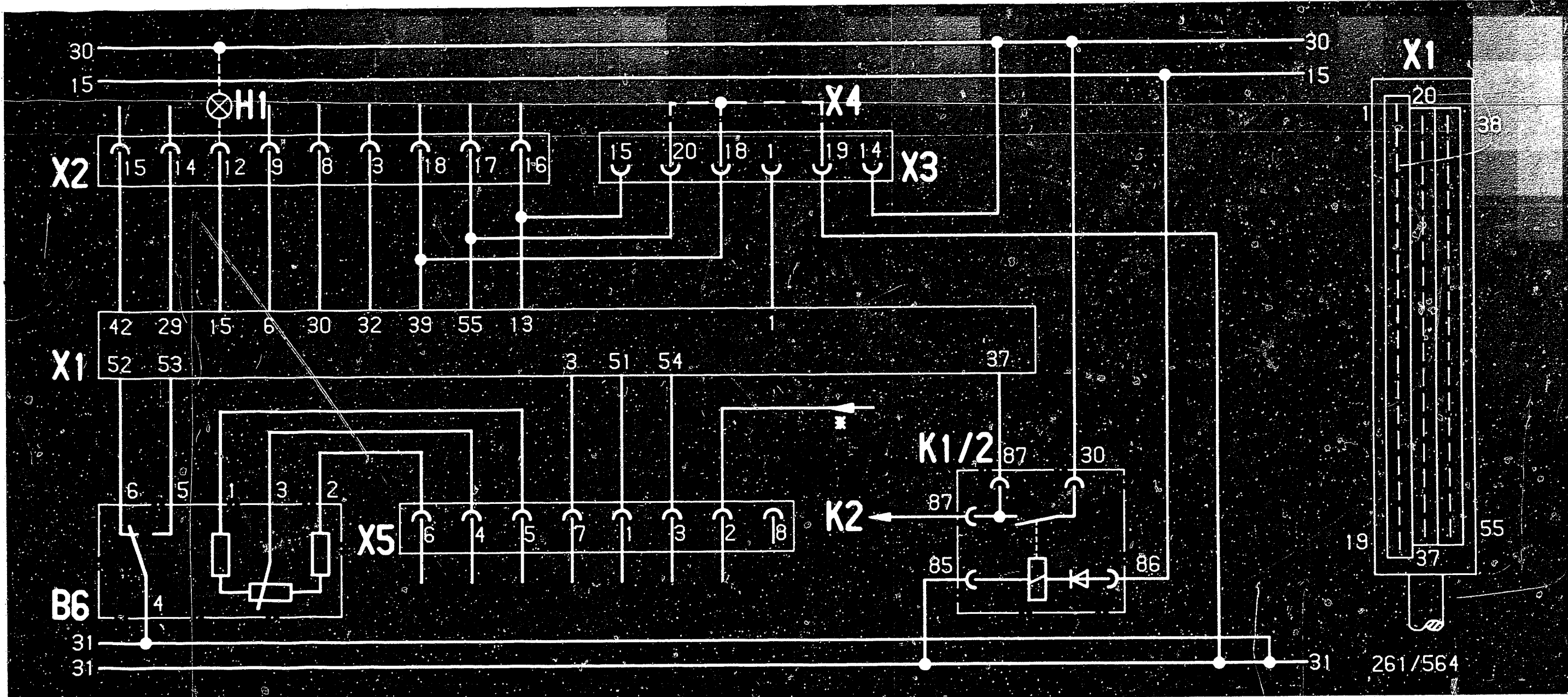
Vehicles with catalytic converter: 0,2...1,2 % CO by
vol.

(measure CO upstream of the catalytic
converter if sampling pick-up fitted,
pull apart lambda-sensor plug).

For production reasons:
continued on the following
coordinate.

See equipment and Autodata microcards for
the settings for valve clearance and other
engine-related data.

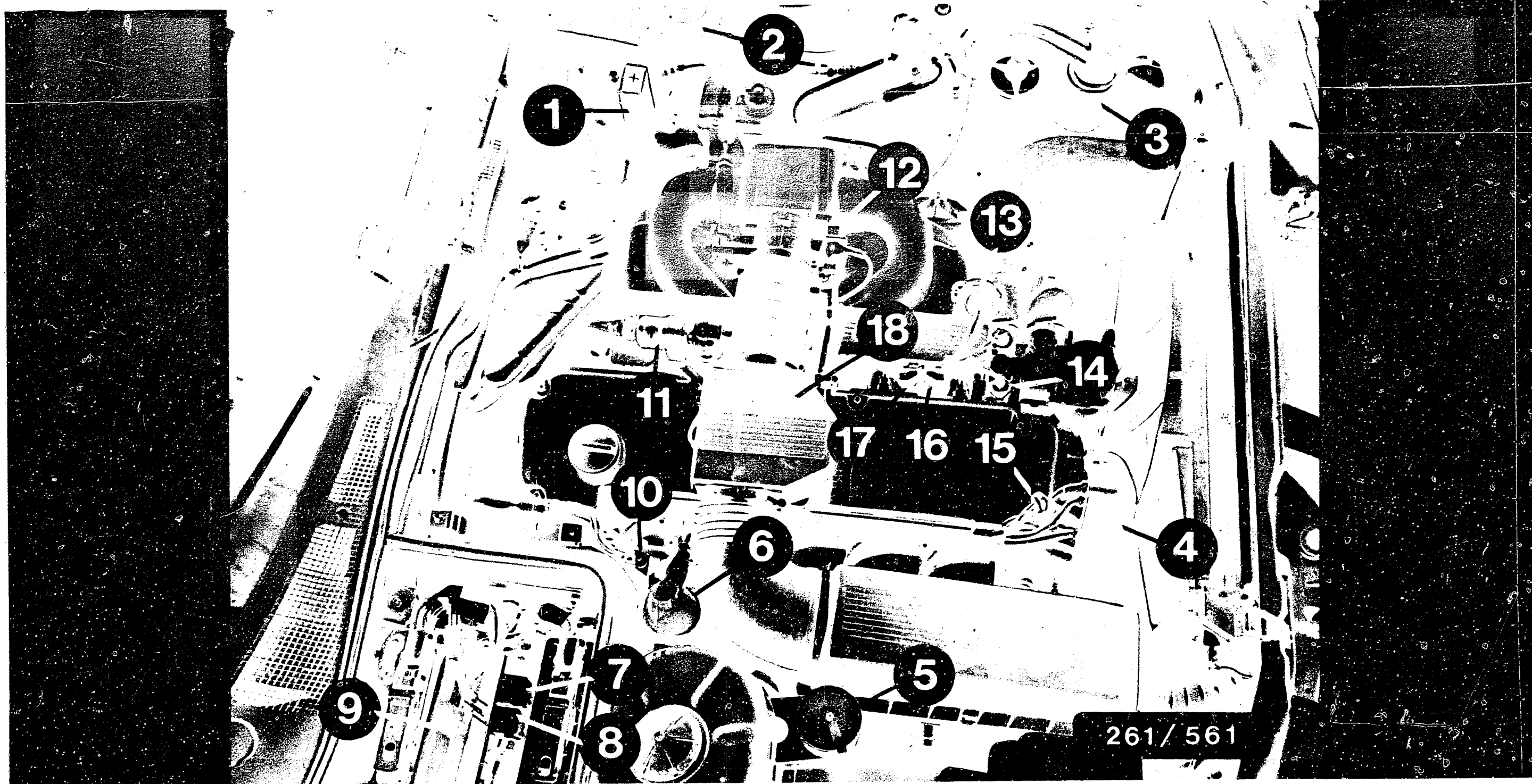




ELECTRICAL TERMINAL DIAGRAM (1)

B6 = Throttle-valve switch with potentiometer
(with electronic trans. control instead of Item S1)
H1 = "CARB" lamp (indicator lamp; US version)
K1/2 = Main relay (circuit up to 12.86)
K2 = Pump relay
* = From main relay term. 87 (+)

X1 = Motronic control-unit plug
X2 = Engine plug (20-pin)
X3 = Diagnostic plug (20-pin)
X4 = Bridge in diagnostic-plug cover
X5 = 8-pin plug to transmission control unit

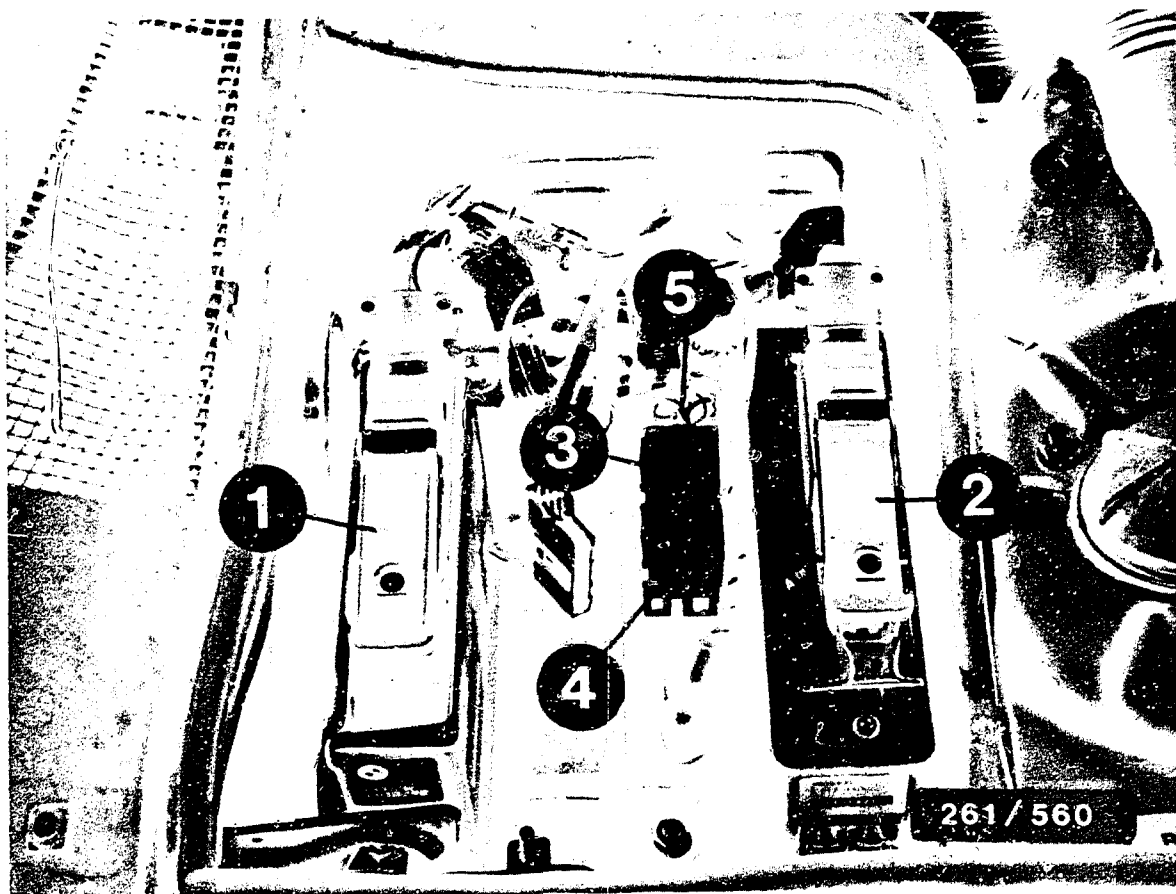


INSTALLATION POSITION OF COMPONENTS

1 = Positive battery terminal
 2 = Engine plug
 3 = Active-carbon container (cat. only)
 4 = High-tension distributor
 5 = Diagnosis socket
 6 = Ignition coil

7 = Main relay
 8 = Pump relay
 9 = Motronic control unit
 10 = Motronic ground terminal
 11 = Idle actuator
 12 = Throttle-valve switch

13 = Fuel-pressure regulator
 14 = Engine-temperature sensor
 15 = High-tension sensor (cyl. 6)
 16 = Plug, high-tension sensor
 17 = Plug, speed/ref. mark sensor
 18 = Air-flow sensor



- 1 = Motronic control unit
- 2 = ABS control unit
- 3 = Main relay
- 4 = Pump relay
- 5 = Plug connection, if transmission control fitted

INSTALLATION POSITION OF COMPONENTS (1)

The installation position given is always as viewed from behind the vehicle.

Control unit:

In the instrument compartment beneath the hood (E box on the right-hand firewall). Unscrew cap.

Main relay:

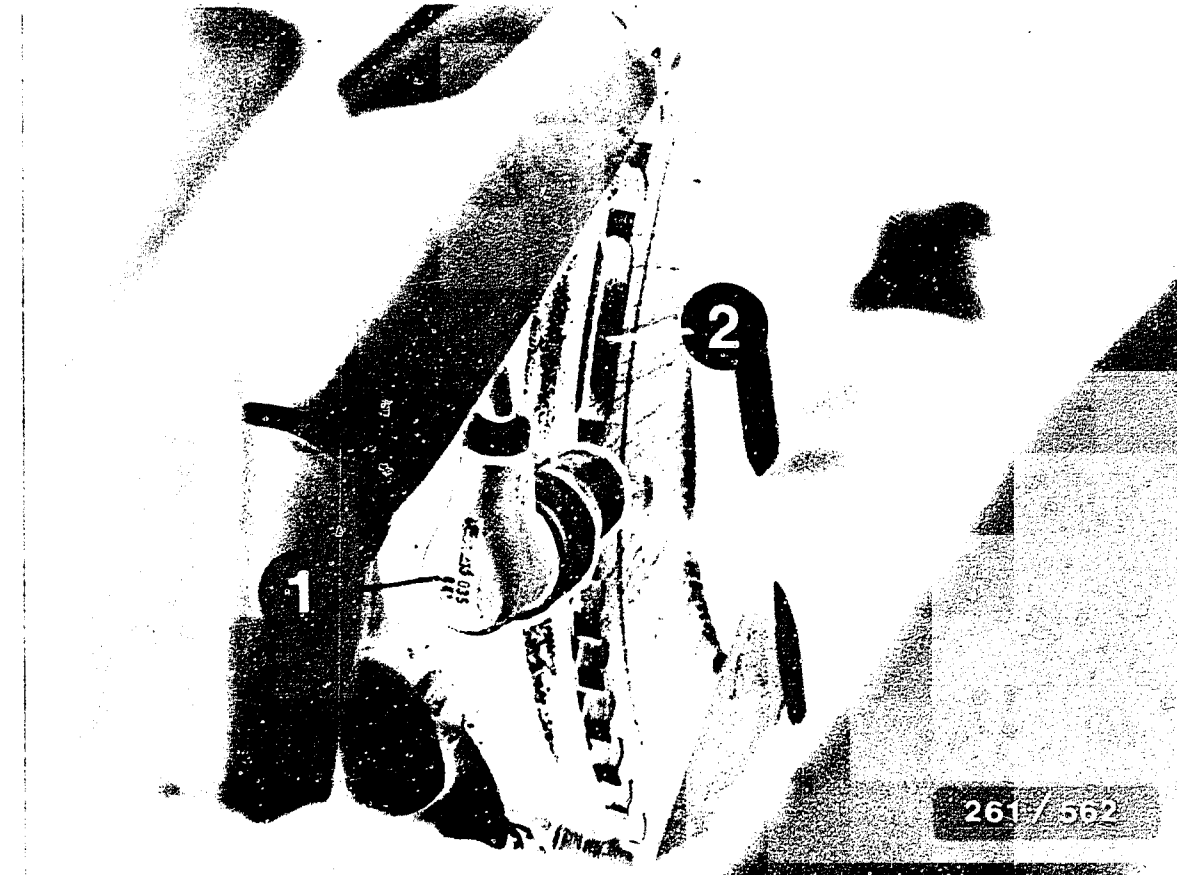
In the instrument compartment. White relay housing.

Pump relay:

In the instrument compartment. Orange relay housing.

Air-temperature sensor:

In the air-flow sensor.



- 1 = Engine-speed/reference-mark sensor
- 2 = Ring gear with gap

Electric fuel pump:
In the fuel tank.

Fuel filter:

Beneath the vehicle, in front of the fuel tank on the right.

Reference-mark/engine-speed sensor:

At front of engine, to the right of the crankshaft ring gear.

Plug connection between the injection valves of cylinders 1 and 2 (left-hand plug connection).

Ground terminal:

Next to the instrument compartment on the left, beneath a cap, close to the ignition coil.

INSTALLATION POSITION OF COMPONENTS (3)

Lambda sensor:

In the common exhaust pipe (arrow, top picture). Round plug connection, 4-pin beneath the starting motor (arrow, center picture).

Tank vent valve:

Mounted on intake manifold in engine compartment, close to oil dipstick (arrow, bottom picture).

Fuse no. 23 for electric fuel pump:

In the fuse box on the left-hand firewall.

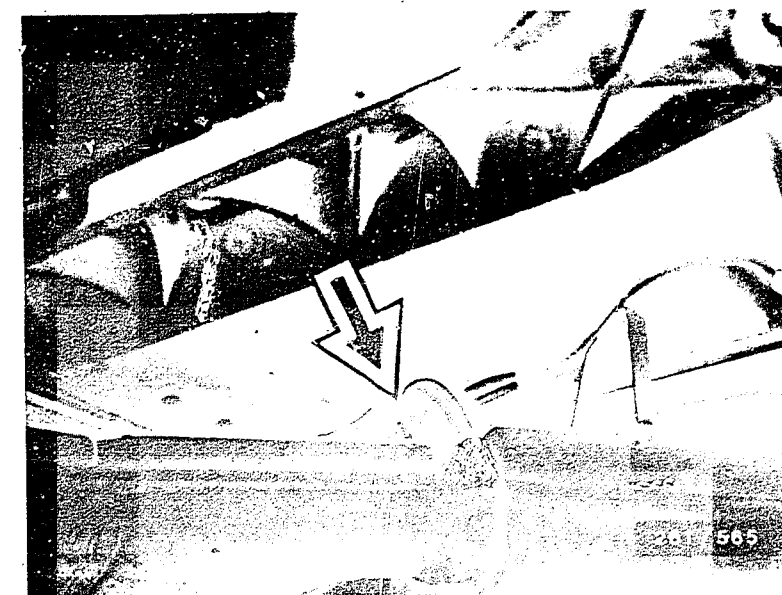
High-tension sensor:

On ignition cable for cylinder 6.

Plug connection between the injection valves of cylinders 1 and 2 (right-hand plug connection).

Battery:

Beneath the rear seat bench.



Trouble-shooting instructions : JAG-5000
BOSCH system : EZ
Make of vehicle : JAGUAR
Basic microcard : PKW-049

TABLE OF CONTENTS

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| Trouble-shooting chart..... | A05 |
| Rapid diagnosis chart..... | A07 |
| Test specifications..... | A13 |
| Electrical terminal diagram..... | A15 |
| Installation position of components, notes on removal/installation..... | A17 |

SPECIAL FEATURES

These trouble-shooting instructions, valid at the time of publication, apply to the following Jaguar model:

XJ 6 with 2.9 l 6-cylinder engine 9.86 ->
EU model without catalytic converter,
A, AUS, CH and J models with catalytic converter.

- * Electronic ignition system with load detection via intake-manifold pressure measurement (EI).
- * Control unit 0 227 400 011 for EU model without catalytic converter.
- * Control unit 0 227 400 015 for A, AUS, CH, J models with catalytic converter.
- * The EU model without catalytic converter is additionally equipped with a vacuum switch-over facility; see basic instructions for more detailed instructions.

USAGE, STRUCTURE

These brief instructions essentially encompass vehicle-specific special features and test specifications (set values).

Corresponding to the customer complaint, the trouble-shooting chart leads to different causes/ component faults.

Detailed instructions with regard to trouble-shooting must be taken from the basic instructions via the trouble-shooting chart.

ATTENTION: Even if reference is made to basic instructions, the set values, terminal assignments and special features in these vehicle-related brief instructions are always binding.

SAFETY AND PRECAUTIONARY MEASURES

Keep people out of danger.
Avoid damage to the engine, control unit or ignition system.

For production reasons:
continued on the following
coordinate.

- * C A U T I O N !
High-performance ignition system.
Dangerous high and low voltages.

Touching live parts or terminals may be dangerous (both on the primary and secondary sides).

- * When testing the compression, disconnect EI control-unit plug or firmly apply ignition coil term. 4 to ground using auxiliary cable.

N o t e :
Auxiliary cable must be interference-suppressed with at least 2 k Ω .

See Basic Instructions for further precautionary measures.

TROUBLE-SHOOTING CHART

Customer complaint (symptoms of trouble)

- Starting motor operates, but engine fails to start or starts only with difficulty.
- Engine starts but then dies.
- Rough idling (engine speed, exhaust gas).
- Poor throttle response.
- Misfiring (ignition, fuel injection).
- Maximum engine power/top speed not reached.
- Fuel consumption too high.
- Engine diesels.
- Engine pings/knocks.
- Engine becomes too hot.
- Fault lamp.

| Cause (component fault) | | | | | | | | | | |
|-------------------------|---|---|---|---|---|--|---|---|--|------------------------------------|
| * | * | * | * | * | * | | | | | High-voltage side |
| * | * | * | * | * | | | | | | Ignition coil |
| * | * | | | | | | | | | Firing sequence |
| * | | | | | | | | | | Voltage, EI control unit |
| * | | | | | | | | | | Voltage, primary circuit |
| | | * | * | | | | | | | Engine-speed reference-mark sensor |
| * | | | | | | | | | | High-voltage distributor |
| * | | | | | | | | | | Contact resistances |
| | * | * | * | * | * | | * | * | | Temperature sensor, coolant |

TROUBLE-SHOOTING CHART

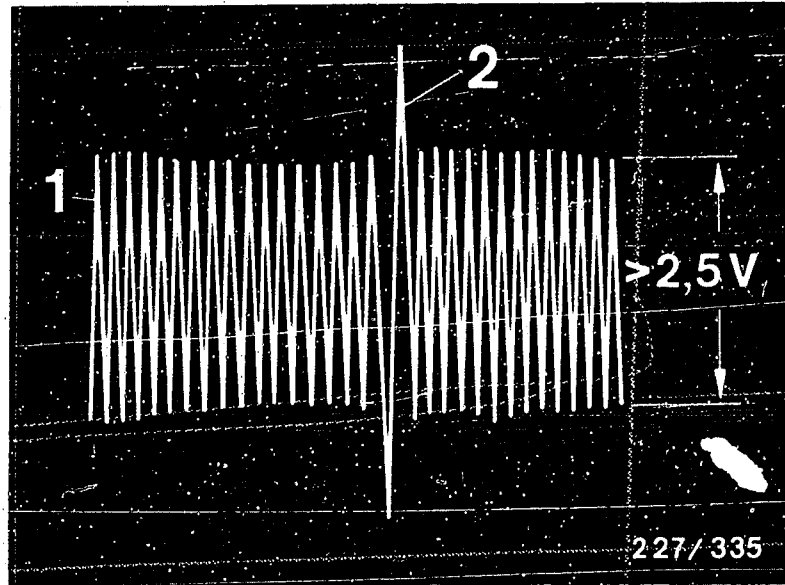
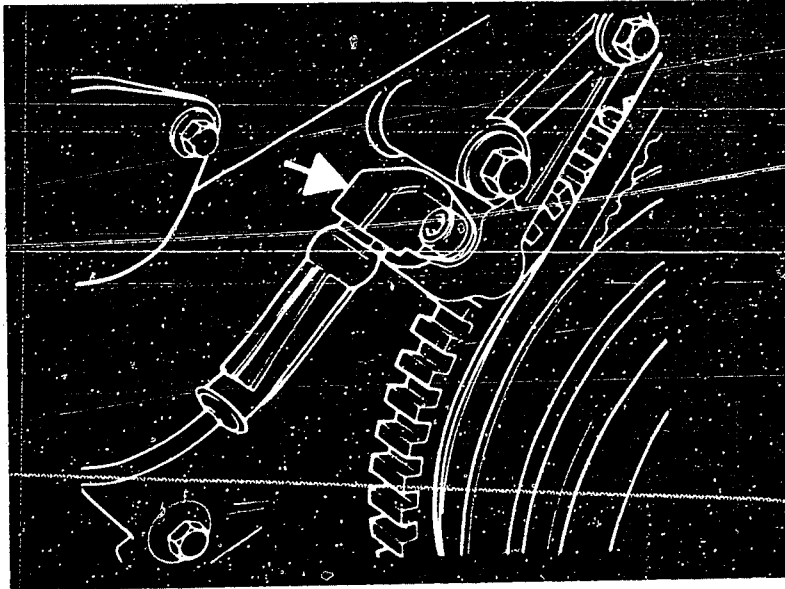
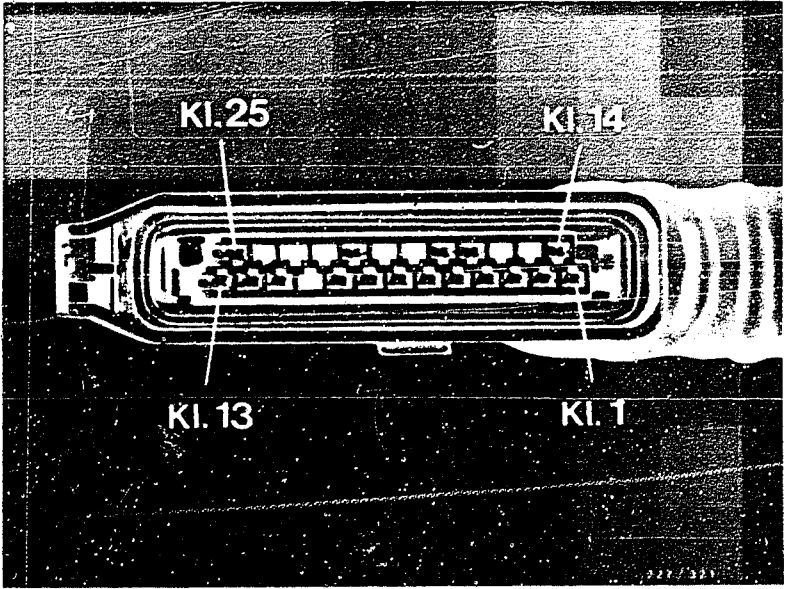
Customer complaint (symptoms of trouble)

- Starting motor operates, but engine fails to start or starts only with difficulty.
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- Maximum engine power/top speed not reached.
- Fuel consumption too high.
- Engine diesels.
- Engine pings/knocks.
- Engine becomes too hot.
- Fault lamp.

| Cause (component fault) | | | | | | | | | | |
|-------------------------|---|---|---|---|---|--|---|---|--|----------------------------------|
| | * | * | * | * | * | | * | * | | Throttle-valve switch, idle |
| | * | * | * | * | * | | * | * | | Throttle-valve switch, full load |
| | | * | | * | * | | | | | Vacuum switch-over |
| | * | * | * | * | * | | * | * | | Ignition point |
| | | * | | | * | | * | * | | Vacuum sensor |
| | | | * | | | | | | | Voltage, EI control unit |
| | | | * | | | | | | | Voltage, ignition coil |
| | | | * | | | | | | | Primary voltage |

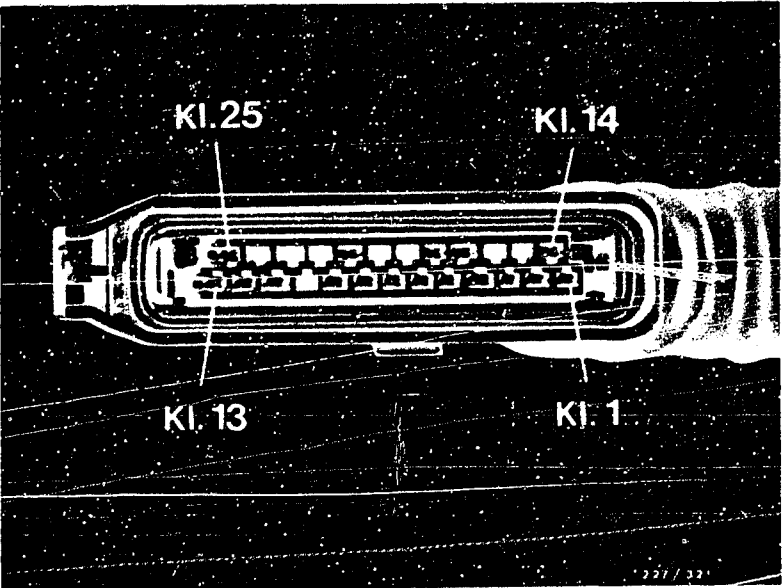
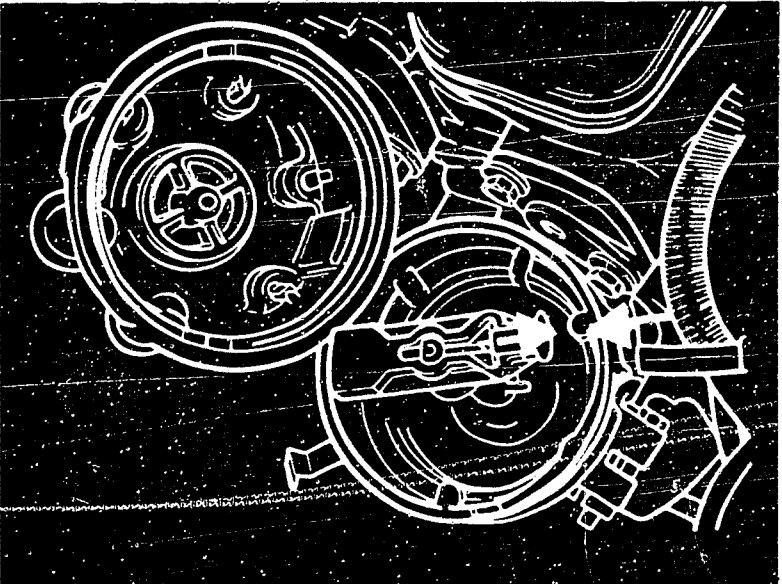
RAPID DIAGNOSIS CHART

| Test step | Testing of component/function Test conditions/instructions | Terms. | Set values |
|-----------|--|--------------------|---|
| 1 | HIGH-VOLTAGE SIDE Visual examination (distributor cap, ignition harness etc). Ignition oscillogram. | — | — |
| 2 | IGNITION COIL Visual examination, plug present, sealing compound escaped? Resistance, primary Resistance, secondary | 1 , 15 1 , 4 | 0,4...0,7 Ω 5,1...8,6 K Ω |
| 3 | VOLTAGE SUPPLY, EI CONTROL UNIT Ignition ON. Voltage, EI control-unit plug | 25 , 12 (+) (-) | Approx. U _B |
| 4 | PRIMARY CIRCUIT Ignition ON. Voltage, EI control-unit plug | 1 , 12 (+) (-) | Approx. U _B |
| 5 | ENGINE-SPEED REFERENCE-MARK SENSOR insulation Resistance, EI control-unit plug | 7 , 20 | > 1 M Ω |
| | ENGINE-SPEED REFERENCE-MARK SENSOR internal resistance Resistance, EI control-unit plug | 7 , 19 | 0,6...1,6 K Ω |
| | ENGINE-SPEED REFERENCE-MARK SENSOR function Start engine. Test signal, EI control-unit plug | 7 , 19 (+) (-) | For test signal, see lower illustration |



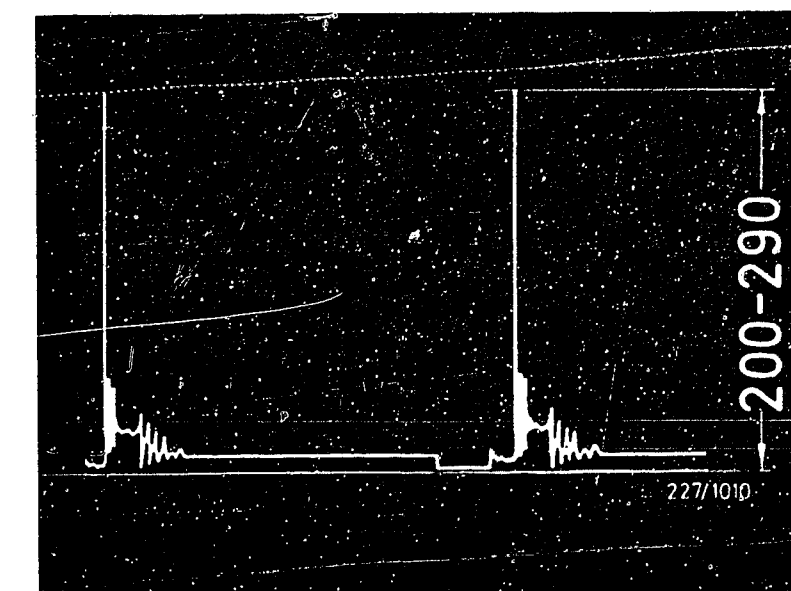
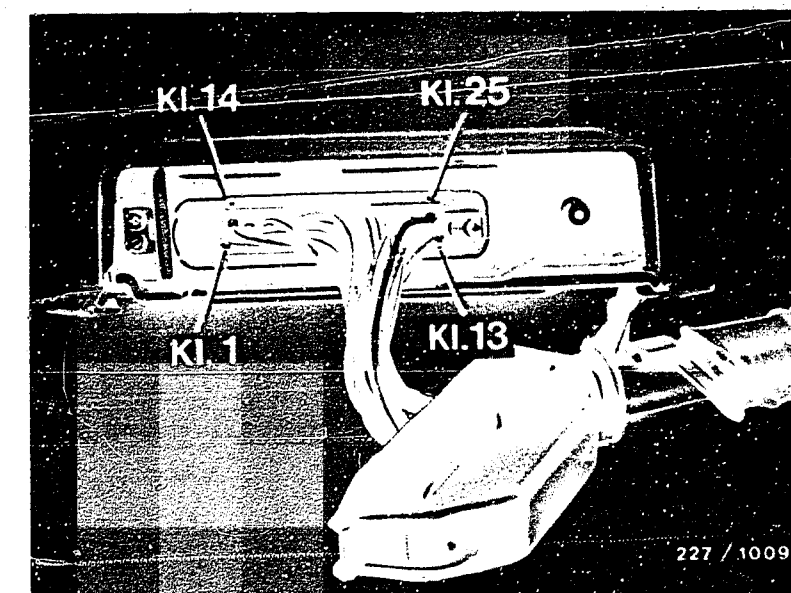
RAPID DIAGNOSIS CHART (continued)

| Test step | Testing of component/function Test conditions/instructions | Terms. | Set values |
|--|--|---------|---|
| 6* | HIGH-VOLTAGE DISTRIBUTOR SETTING Engine cyl. 1 at TDC. Distributor rotor points to housing marking. | — | — |
| | CONTACT RESISTANCES Check voltage-supply leads from control unit/ primary circuit for contact resistance. | | max. 0,3 Ω |
| 7 | COOLANT TEMPERATURE SENSOR Resistance, EI control-unit plug with temperature at + 20°C + 30°C + 80°C + 90°C + 100°C | 23 , 12 | 2,1...2,9 k Ω 1,4...2,0 k Ω 280...370 Ω 210...280 Ω 160...210 Ω |
| 8 | IDLE THROTTLE-VALVE SWITCH Resistance, EI control-unit plug | 4 , 12 | Approx. 0 Ω |
| 9 | FULL-LOAD THROTTLE-VALVE SWITCH Resistance, EI control-unit plug | 17 , 12 | Approx. 0 Ω |
| 10 | VACUUM SWITCH-OVER (EU model without catalytic converter only) Disconnect throttle-valve-switch plug. Run engine at idle, read off spark advance. Disconnect blue-green cable from temperature switch and apply to vehicle ground using auxiliary cable. Read off spark advance. | | Spark-advance change |
| * Perform only when engine is not running. | | | |



RAPID DIAGNOSIS CHART (continued)

| Test step | Testing of components/function Test conditions/instructions | Terms | Set values |
|-----------|---|--------------------|---|
| 11 | SPARK ADVANCE Engine at normal operating temperature, at idle. Read off spark advance. | | 5...11° before TDC at 600...700 min ⁻¹ |
| 12 | VACUUM SENSOR Engine at normal operating temperature, at idle. Disconnect throttle-valve-switch plug. Disconnect vacuum hose from intake manifold and connect to vacuum pump. Read off spark advance. Build up vacuum of approx. 400 mbar. Read off spark advance. | | Spark-advance change, "Advance" |
| 13 | VOLTAGE SUPPLY, EI CONTROL UNIT Engine at idle. Voltage, EI control-unit plug with handle grip removed | 25 , 12 (+) (-) | 12...14 V, max. 1 V below U _B |
| 14 | VOLTAGE SUPPLY, IGNITION COIL Engine at idle. Voltage, ignition coil and vehicle ground. | 15 , B- (+) (-) | min. 10 V |
| 15 | PRIMARY VOLTAGE Voltage, ignition coil with engine at idle. | 15 , 1 (+) (-) | 200...290 V |



TEST SPECIFICATIONS

Ignition coil, primary 0,4...0,7 Ω
 Ignition coil, secondary 5,1...8,6 k Ω

Temperature sensor,
 coolant
 Resistance at
 coolant
 temperature

| | |
|--------|----------------------|
| 20° C | 2,1...2,9 k Ω |
| 30° C | 1,4...2,0 k Ω |
| 80° C | 280...370 Ω |
| 90° C | 210...280 Ω |
| 100° C | 160...210 Ω |

Spark advance with
 engine at idle 5...11° before TDC
 (600...700 min ⁻¹)

Voltage supply,
 control unit with
 engine at idle 12...14 V

For production reasons:
 continued on the following
 coordinate.

Voltage supply,
 ignition coil with
 engine at idle min. 10 V

Primary voltage
 with engine at idle 200...290 V

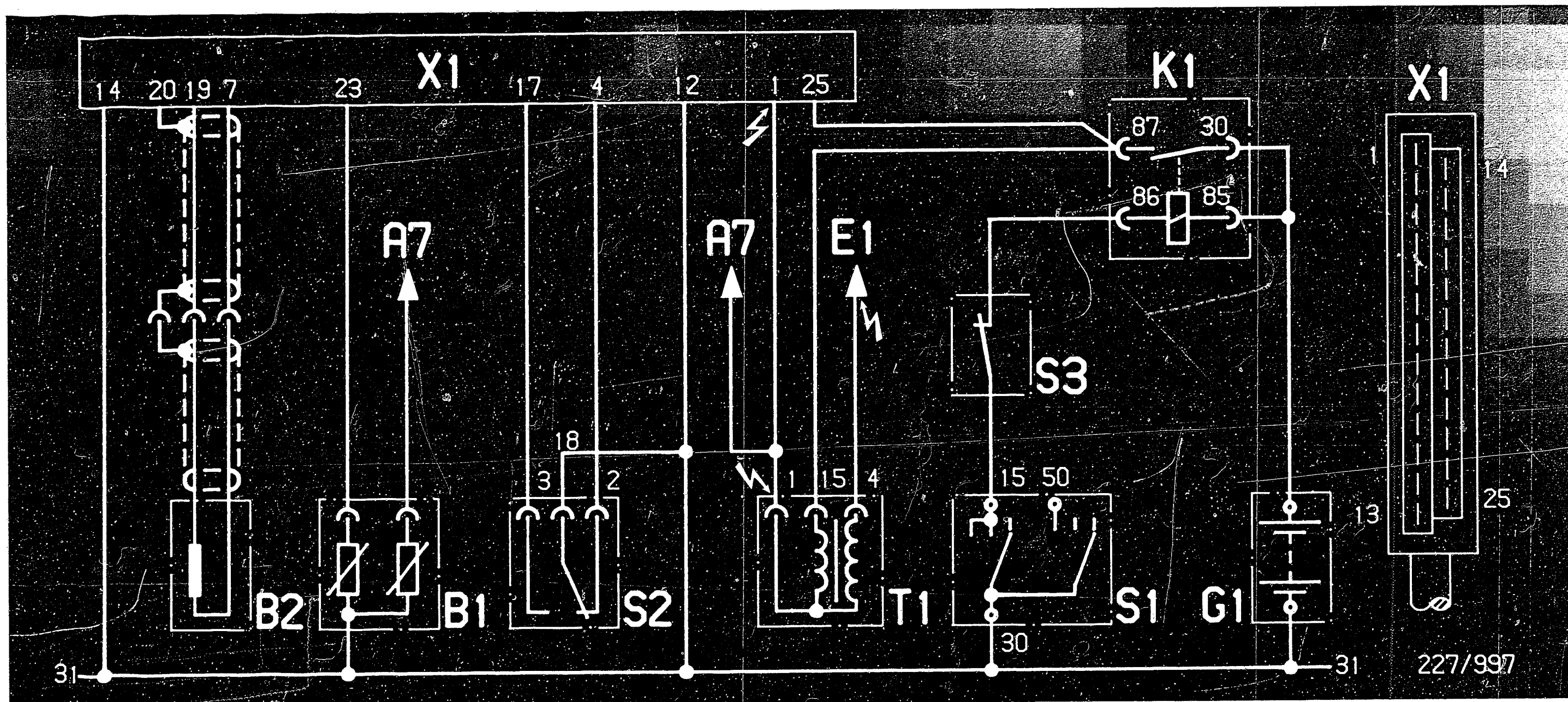
Engine-speed reference-
 mark sensor

Insulation > 1 M Ω

Internal resistance 0,6...1,6 k Ω

Voltage U_{pp} > 2,5 V

See LH-Jetronic microcard for setting
 values for exhaust gas etc.



High-voltage symbols: Danger, 400 V...25 kV

A7 = to LH-Jetronic control unit

B1 = Temperature sensor
coolant

B2 = Engine-speed reference-mark sensor

E1 = to high-voltage distributor

G1 = Battery

K1 = Supply relay

S1 = Ignition switch (negative-switching)

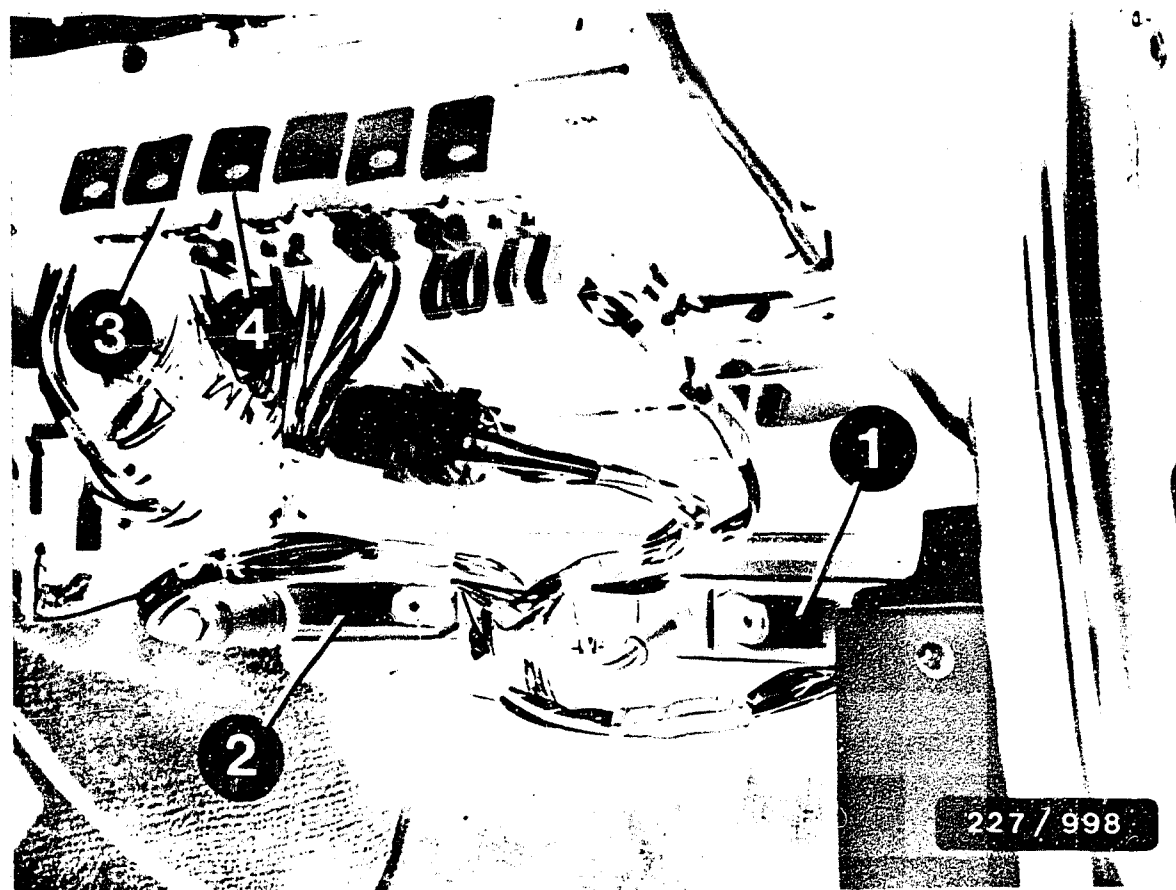
S2 = Throttle-valve switch

S3 = Impact switch

T1 = Ignition coil

X1 = EI control unit

ELECTRICAL TERMINAL DIAGRAM



INSTALLATION POSITION OF COMPONENTS

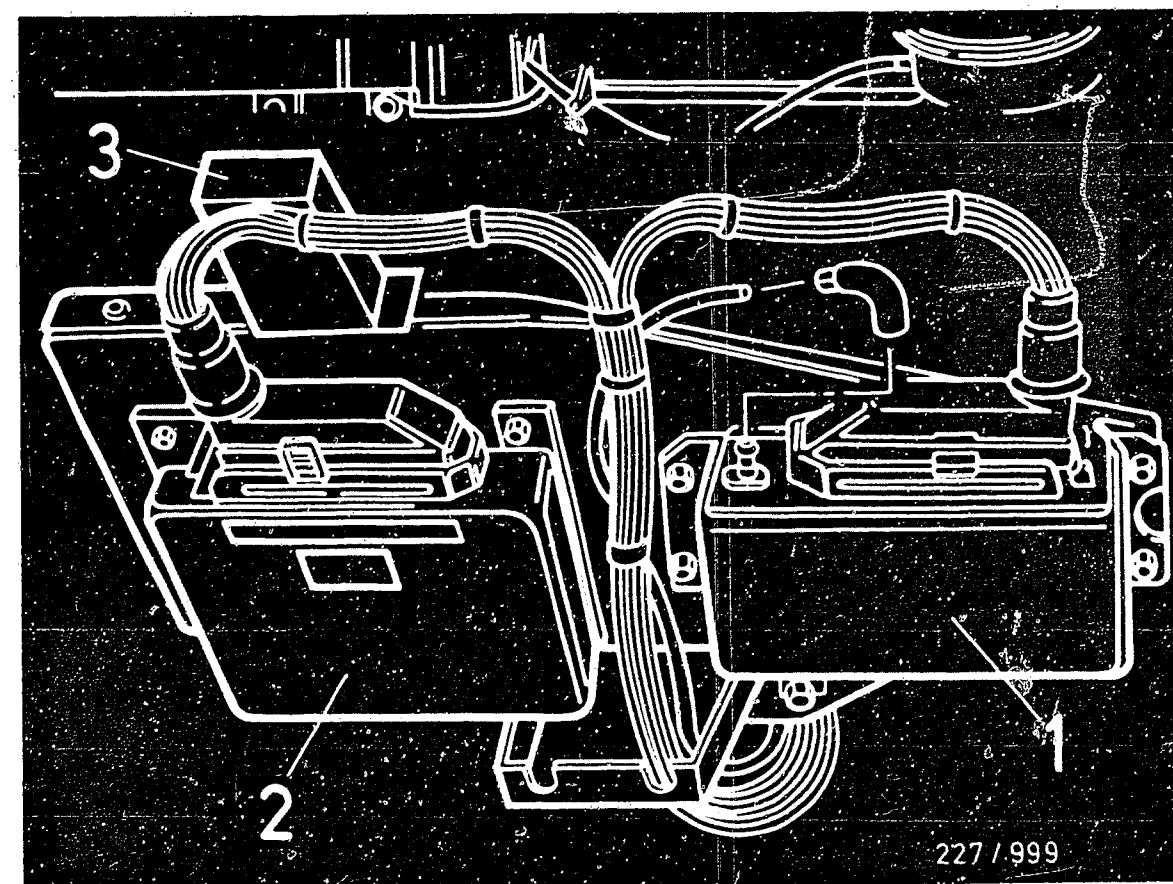
- 1 = EI control unit
- 2 = LH-Jetronic control unit
- 3 = Supply relay, ignition
- 4 = Supply relay, Jetronic

The control units for the ignition and Jetronic are positioned beneath the glove compartment.

Note on removal:

Remove lower instrument-panel trim and pull trim away downward.

Note: In a right-hand drive vehicle, the installation positioning of these components is a mirror image of that shown with the functions remaining the same.

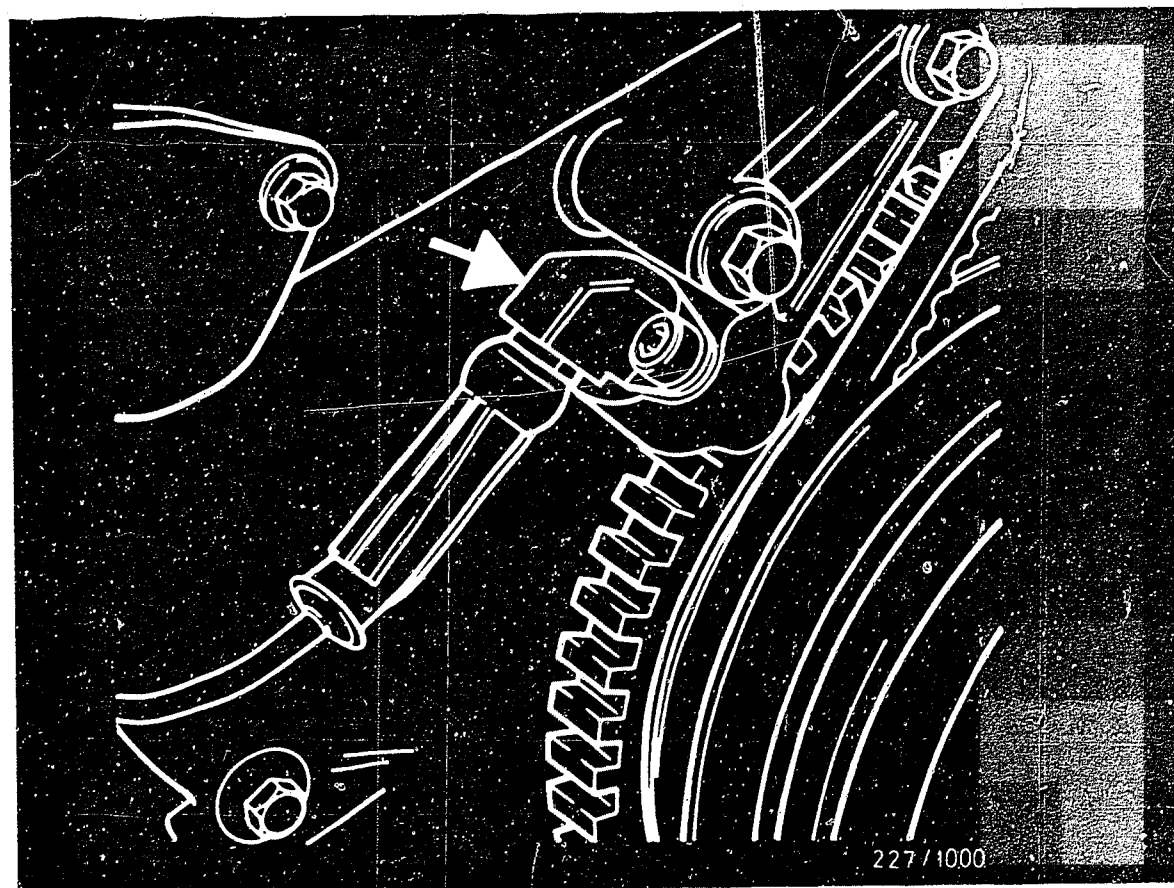


Installation position of components (continued)

The time-lag relay is positioned close to the Jetronic control unit, see upper illustration.

Further components of the vacuum switch-over facility:

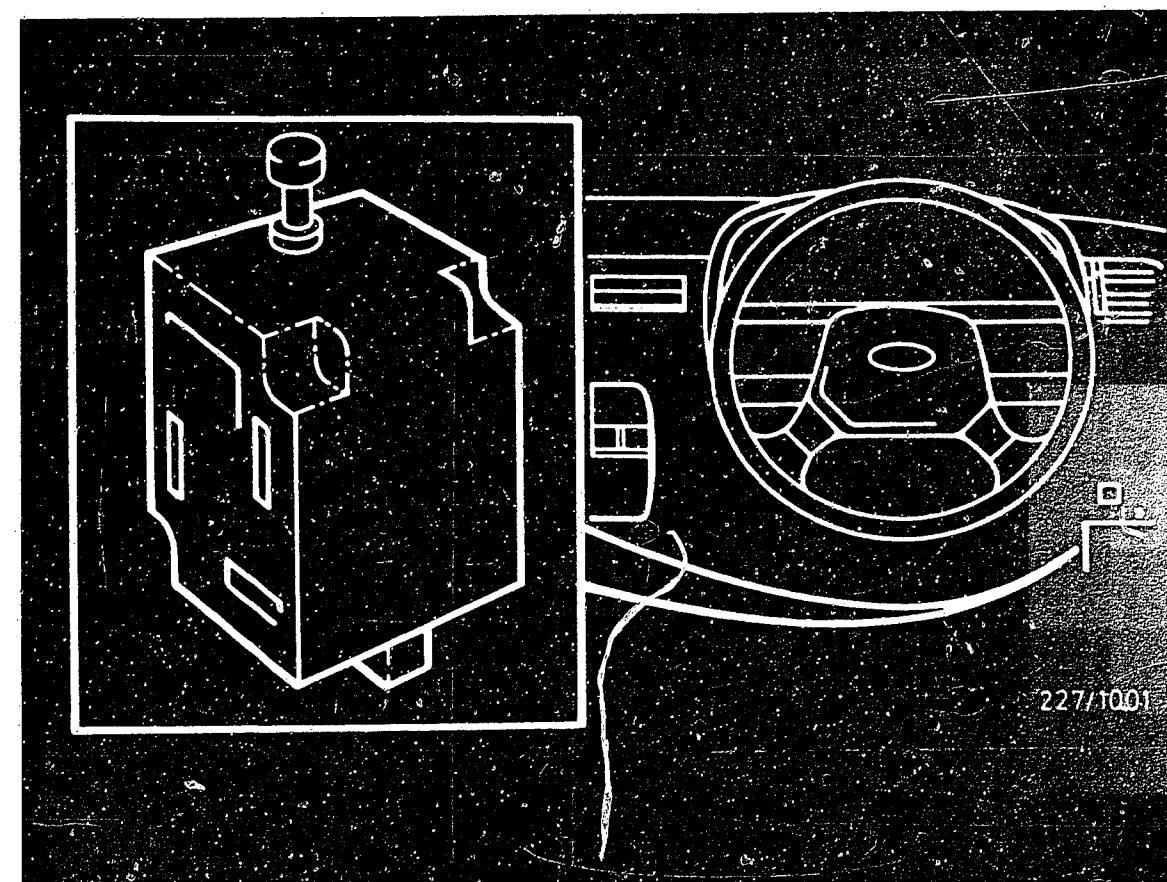
- 1. Temperature switch: next to the coolant temperature sensor.
- 2. 3-way solenoid-operated valve: at the rear end of the intake manifold.
- 3. Delay valve: in the hose line to the throttle-valve assembly.



Installation position of components (continued)

Arrow = Engine-speed reference-mark sensor

The engine-speed reference-mark sensor is positioned at the end face of the engine behind the crankshaft pulley.



Installation position of components (continued)

The impact switch is positioned on the driver's side behind the side panelling, see upper illustration.

In the case of a heavy impact (accident), the impact switch interrupts the voltage supply to the ignition system and electric fuel pump. The switch can be reset by pressing the pin on the upper side of the housing.

Installation position of components (continued)

The coolant temperature sensor is positioned on the thermostat housing (upper illustration)

The throttle-valve switch is positioned below the throttle-valve assembly, (center illustration) arrow

The high-voltage distributor is mounted on the right-hand side of the engine (lower illustration, 1).
The ignition coil is mounted on the right-hand inner fender, (lower illustration, 2).

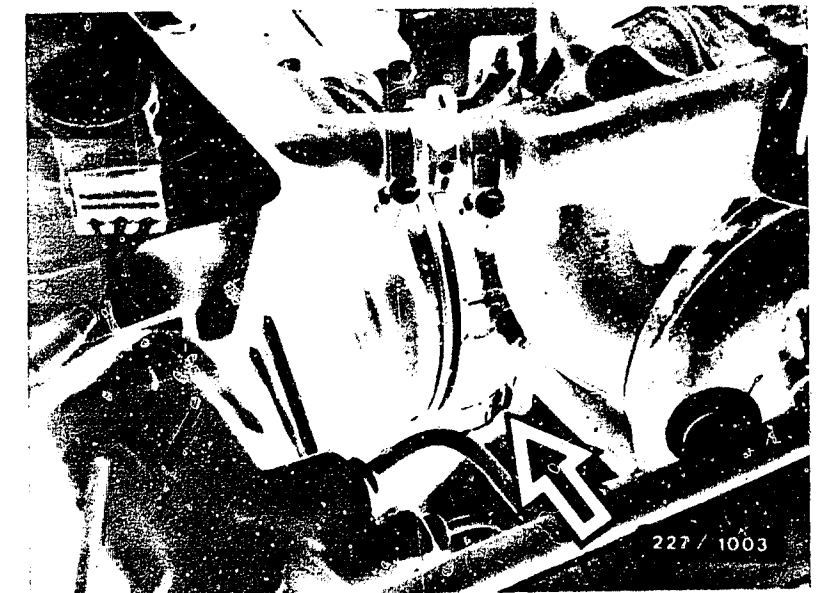
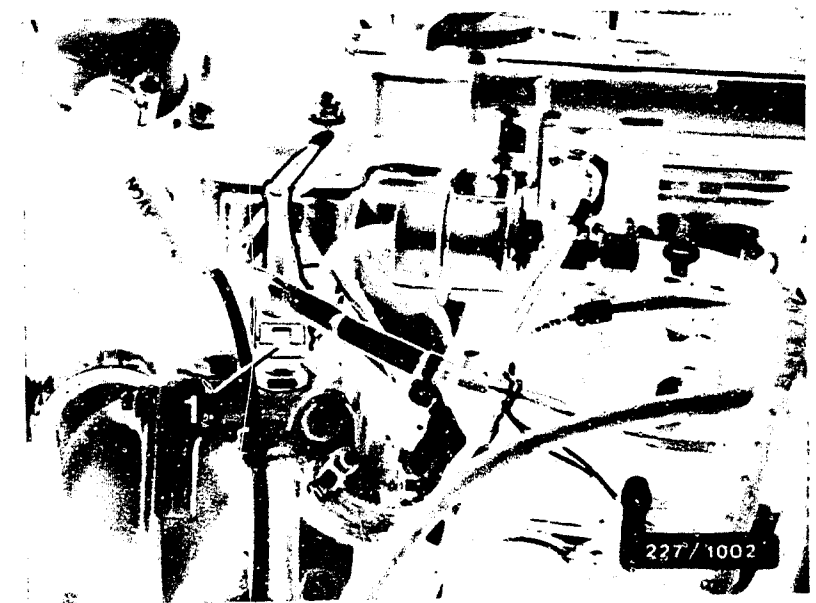


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Trouble-shooting instructions : OPE-5001
BOSCH system : Ecotronic (2 Z)

Make of vehicle : OPEL
Basic microcard : PKW - 047

| Section | Coordinate |
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| Special features, safety, usage..... | 02 |
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SPECIAL FEATURES

- * This microcard contains the ECO2Z trouble-shooting instructions, valid at the time of publication, for the following Opel models:

Omega 1,8 S (10.86 ->)
(with S 18 NV and E 18 NV engine)
- * Ecotronic with integral characteristic-map ignition (ECO2Z) with 35-pin control unit.
- * The control unit is equipped with self-diagnosis. If a fault should arise in the system, it is stored in the fault memory. At the same time, the warning/diagnosis lamp in the instrument panel lights up. If a sensor fails, the control unit operates with specified substitute values.

STRUCTURE, USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble-shooting chart leads to various causes/component faults.

Detailed instructions for trouble-shooting must be taken from the basic instructions via the trouble-shooting chart.

ATTENTION: Even if reference is made to basic instructions, the set values, terminal assignments and special features of these vehicle-related brief instructions are always binding.

Finding individual test steps in the brief and basic instructions is made easier through the use of identical test-step numbers.

SAFETY AND PRECAUTIONARY MEASURES

In order to keep persons out of danger and to prevent damage to the engine, control unit or ignition system, be sure to observe the safety and precautionary measures in the basic instructions.

*** C A U T I O N !**

High-performance ignition system.
Dangerous primary and secondary voltages.

Touching voltage-carrying components or terminals may prove fatal (both on the primary and secondary sides).

For further precautionary measures,
see basic instructions.

TROUBLE-SHOOTING CHART

Customer complaint (symptoms of trouble)

1. Starting motor operates, but engine fails to start or starts only with difficulty.
2. Engine starts but then dies.
3. Rough idling (engine speed, exhaust gas).
4. Poor throttle response, flat spot during acceleration.
5. Engine misfiring (ignition, fuel induction).
6. Maximum engine power/top speed not reached.
7. Fuel consumption too high.
8. Engine running on (dieseling).
9. Engine pinging/knocking.
10. Engine overheating.
11. Fault lamp.

| | Cause (component fault) |
|-----------|------------------------------------|
| * * * * * | Evaluate self-diagnosis |
| * | Fault lamp defective |
| * * | Engine-speed/reference-mark sensor |
| * | Test primary side |
| * * * * * | Test secondary side |
| * * | Poor fuel quality |
| * * * | Fuel pressure |
| * * | Fuel filter |
| * * * * * | Choke-valve flap |
| * * * * | Float/float-needle valve |
| * * * * * | Dirt in carburetor |
| * * * * | Intake system leaking |
| * * | Intake-manifold heating |
| * * | Intake-air preheating |
| * | Alternator, interference-suppress. |
| * * | Bypass heating |

TROUBLE-SHOOTING CHART (continued)

Customer complaint (symptoms of trouble)

- Starting motor operates, but engine fails to start or starts only with difficulty.
- Engine starts but then dies.
- Rough idling (engine speed, exhaust gas).
- Poor throttle response, flat spot during acceleration.
- Engine misfiring (ignition, fuel induction).
- Maximum engine power/top speed not reached.
- Fuel consumption too high.
- Engine running on (dieseling).
- Engine pinging/knocking.
- Engine overheating.
- Fault lamp.

| Cause (component fault) | | | | | | | | | |
|-------------------------|---|---|---|---|---|---|---|--|-------------------------------------|
| | * | | | | | * | | | Adjustment, throttle valve Stage I |
| | * | * | * | * | * | | | | Incorrect type of nozzle |
| | | * | | * | | | | | Vacuum unit, Stage II |
| | * | * | | * | | | | | Adjustment, throttle valve Stage II |
| | * | * | | | | | | | Exhaust-gas recirculation |
| | | * | | * | * | | | | Adjustment, accelerator actuation |
| | * | | | | | | | | Idle CO adjustment |
| | * | * | | | | | | | Throttle valve worn |
| | | | | | | * | * | | Test octane-rating adaptation |
| | | * | | | | | | | Release and forced return |

For production reasons:
continued on the following
coordinate.

SELF-DIAGNOSIS TEST TABLE

| Fault indication Flash code | Testing of component/function | Test instructions/Test conditions | Termi- nals | Set values |
|--------------------------------|---|---|-----------------------|---|
| 1 2 | Control unit, diagnosis output | Control unit indicates that it is in the diagnosis mode. | 30 | — |
| 1 4 | Coolant-temperature sensor (short circuit to ground) | Resistance of temperature sensor: at 20°C at 80°C | 13 23 13 23 | 2...3 k Ω 280...360 Ω |
| 1 5 | Coolant-temperature sensor (open circuit) | | | |
| 2 2 | Throttle-valve potentiometer (short circuit to ground and/or open circuit) | Resistance, throttle-valve potentiometer and throttle-valve actuator (parallel): Wiper resistance, throttle-valve potentiometer: Run engine at idle. Seal off ventilating side of throttle-valve actuator. Switch off engine. Switch on ignition. Accelerator pedal in idle position: Accelerator pedal in full-load position: Resistance changes constantly between min. and max. | 9 6 9 7 9 7 | 0,7...1,3 k Ω min. less than 270 Ω max. 1,4...2,4 k Ω |
| 4 1 | Intake-manifold temperature (short circuit to ground) | Resistance of temperature sensor: at 20°C at 80°C | 22 23 22 23 | 2...3 k Ω 280...360 Ω |
| 4 3 | Intake-manifold temperature sensor (open circuit) | | | |
| 4 8 | Supply voltage too low | | 4 5 + — | greater than 10 V |
| 4 9 | Supply voltage too high | Test alternator/alternator regulator | 4 5 + — | less than 15 V |
| 5 1 | Control unit defective | After all faults have been read out. Clear fault memory. Run engine briefly. Repeat self-diagnosis output. If a fault is indicated again, replace the control unit. | — | — |

SELF-DIAGNOSIS TEST TABLE (Continued)

| Fault indication Flash code | Testing of component/functions | Test instructions/Test conditions | Terminals | Set values |
|--------------------------------|---|--|---------------------|--|
| 5 3 | Potentiometer in throttle-valve actuator (open circuit) | Resistance, throttle-valve potentiometer and throttle-valve actuator (parallel): Wiper resistance, potentiometer in throttle-valve actuator: (activate evacuating valve in throttle-valve actuator while testing and pull back throttle-valve actuator with hand vacuum pump.) Resistance decreases continuously. | 9 6 28 6 28 6 | 0,7...1,3 k Ω min. less than 400 Ω max. 1,4...2,6 k Ω |
| 5 4 | Potentiometer in throttle-valve actuator (short circuit to ground) | | | |
| 5 6 | Choke-valve actuator, current too high | Insulation resistance of choke-valve actuator: | 14 5 | greater than 1 M Ω |
| 5 7 | Choke-valve actuator, current too low | Winding resistance of choke-valve actuator: | 14 15 | 0,9...1,7 Ω |
| 5 8 | Input for CO adjustment (short circuit to ground) | Insulation resistance, input for CO adjustment: (adjustment plug disconnected) | 10 5 | greater than 1 M Ω |
| 5 9 | Throttle-valve actuator extends too slowly | Fault is indicated only if engine is running at idle during diagnosis output. | | |
| 6 1 | Throttle-valve actuator retracts too slowly | Switch off engine and check time it takes throttle-valve actuator to extend/retract: Retraction: Extension: | — — | max. 1 s max. 1 s |
| 6 2 | Ventilating valve in throttle-valve actuator | Insulation resistance, ventilating valve: Winding resistance, ventilating valve: | 34 5 34 35 | greater than 1 M Ω 20...70 Ω |
| 6 3 | Evacuating valve in throttle-valve actuator | Insulation resistance, evacuating valve: Winding resistance, evacuating valve: | 33 5 33 35 | greater than 1 M Ω 20...70 Ω |

TEST SPECIFICATIONS:

Idle speed: 830 ± 50 min-1
with idle-speed increase 930 ± 50 min-1

CO adjustment:
CO value with engine at normal operating temperature 0,2...0,3 % CO by vol.

With CO adjustment plug plugged in 0,5...1,5 % CO by vol.

Fuel pressure: 0,1...0,3 bar

Minimum fuel delivery (at 2000 min-1) 1 l/min

Float weight: 8,3 ± 0,3 g
Float height: 27,5 ± 1,0 mm
(Float level cannot be adjusted)

Throttle-valve potentiometer
Total resistance: 1,4...2,6 k Ω
Wiper resistance in correcting range: min. less than 270 Ω
max. 1,4...2,4 k Ω

Choke-valve actuator:
Winding resistance: 0,9...1,7 Ω

Basic setting, throttle valve Stage II: $a = 0,05 \pm 0,2 \text{ mm}$

Release and forced return Stage II: $Y = 0,4 \pm 0,3 \text{ mm}$
 $Z = 0,3 \pm 0,2 \text{ mm}$

Tightening torques
Flange mounting 9 Nm

TEST SPECIFICATIONS (continued):

Throttle-valve actuator
evacuating valve (term.1/term.2): 20...70 Ω
ventilating valve (term.6/term.7): 20...70 Ω
Total resistance,
potentiometer (term.3/term.4): 1,4...2,6 k Ω
Wiper resistance in correcting range (term.5/term.3):
min. less than 400 Ω
max. 1,4...2,4 k Ω

Inductive engine-speed and reference-mark sensor:
Internal resistance 0,5...0,8 k Ω

Temperature sensor (NTC):
Internal resistance at 20°C: 2...3,2,4 k Ω
at 80°C: 280...360 Ω

Heating element, intake-manifold heating:
Internal resistance at 20°C: 0,6...0,7 Ω

Heating element, bypass heating:
Internal resistance at 20°C: 1,4...2,1 Ω

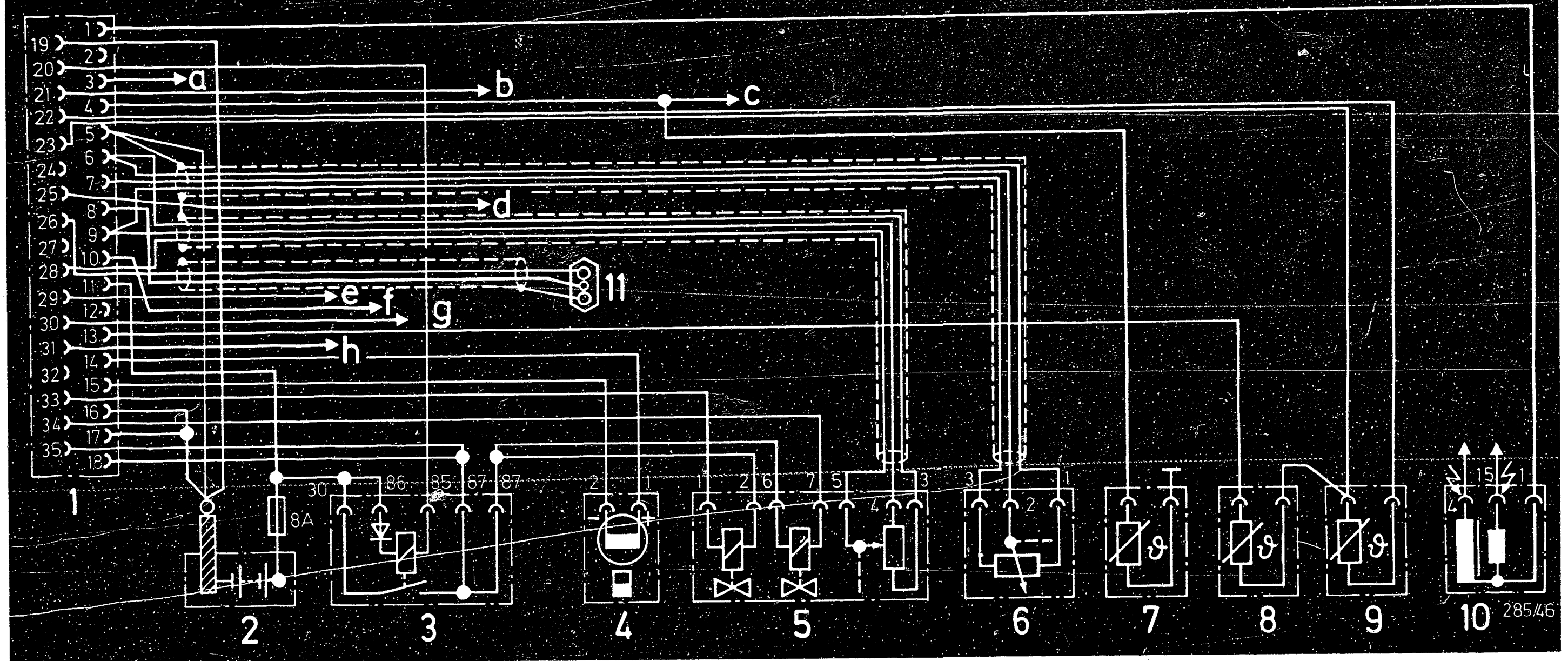
| Type of nozzle: | Stage 1 | Stage 2 |
|-----------------------|---------|---------|
| Main nozzle | x 110 | x 135 |
| Idle fuel nozzle | x 52,5 | |
| Air-correction nozzle | x 110 | x 70 |

Coding plug, octane-rating adaptation:

Resistance at:
91 RON: infinity Ohms
95 RON: 0 Ω

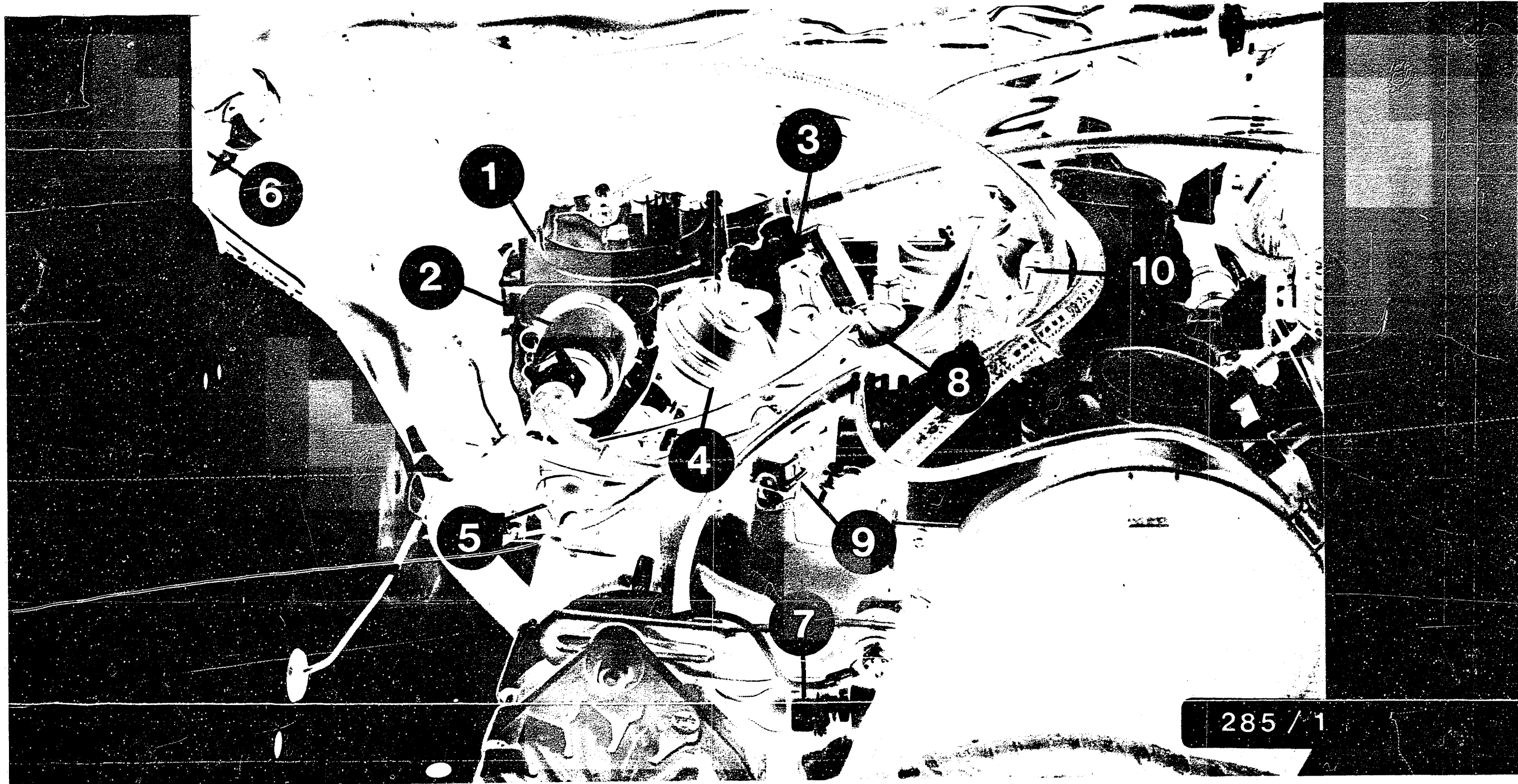
Voltage supply for potentiometer (throttle valve and throttle-valve actuator) and temperature sensor: 4,5...5,5 V

See equipment and Autodata microcards for the setting values for valve clearance and other engine-related data.



ELECTRICAL TERMINAL DIAGRAM

- | | | |
|---|----------------------------------|---|
| 1 = Control unit, Ecotronic with ign. | 8 = Coolant-temperature sensor | e = Idle-speed increase (with increase to ground) |
| 2 = Battery | 9 = Intake-manifold temp. sensor | f = Input for CO adjustment |
| 3 = Control relay | 10 = Ignition coil | g = Diagnostic lamp |
| 4 = Choke-valve actuator | 11 = Reference-mark sensor | h = Diagnosis stimulation lead |
| 5 = Throttle-valve actuator | a = To intake-man. heating relay | |
| 6 = Potentiometer, main throttle valve (HD pot) | b = TD output | |
| 7 = Bypass heating element | c = To central electrics | |
| | d = Octane-rating adaptation | |



INSTALLATION POSITION OF COMPONENTS

1 = Carburetor
 2 = Choke-valve actuator
 3 = Throttle-valve positioner
 4 = Vacuum unit, stage 2
 5 = Throttle-valve potentiometer

6 = Diagnosis plug
 7 = Temperature sensor, coolant
 8 = Exhaust-gas recirculation valve
 9 = Temperature sensor, intake manifold
 10 = Plug connection, reference-mark sensor

INSTALLATION POSITION OF COMPONENTS (continued)

The Ecotronic control unit with integrated ignition is installed in the right footwell beneath the covering (upper illustration). In the illustration, the covering has already been removed. For the purposes of octane-number adaptation, in vehicles with the S 18 NV engine a code strip is located in the wiring harness (upper illustration, 1) and in vehicles with the E 1 NV engine a coding plug is installed in the engine compartment on the right behind the spring-strut dome.

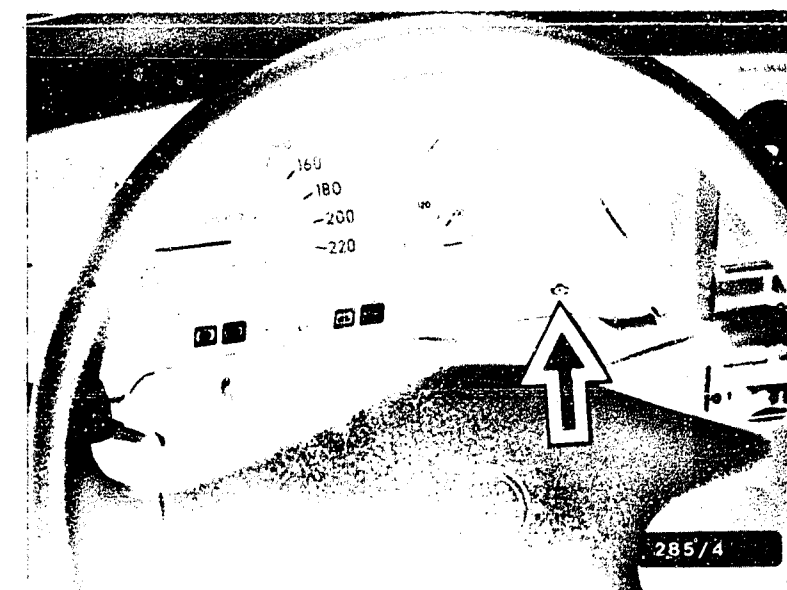
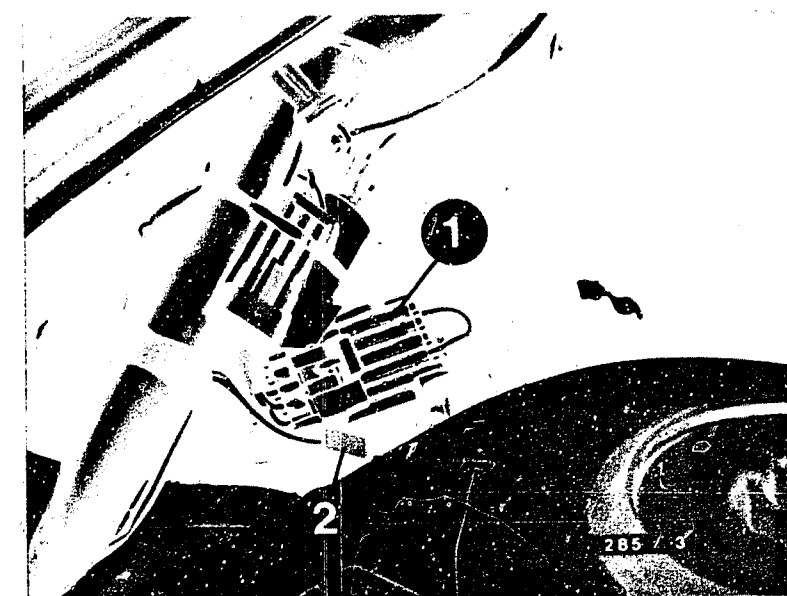
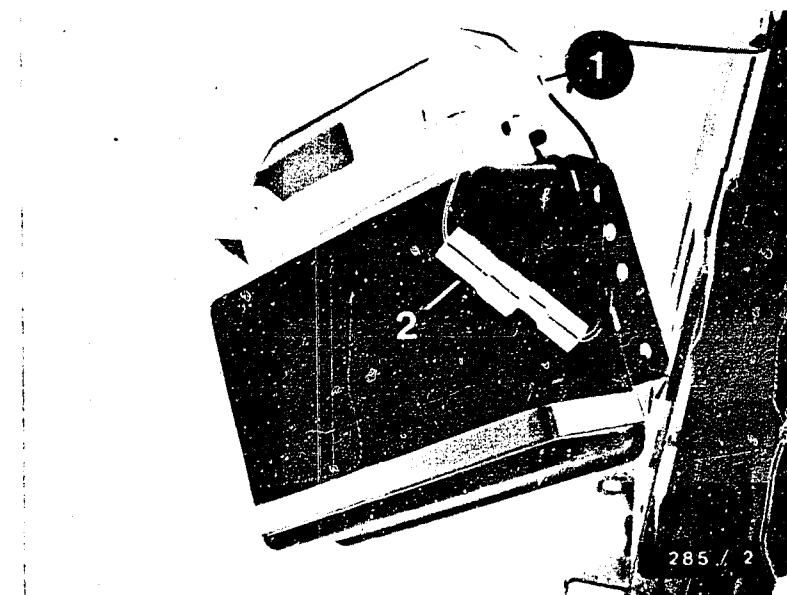
The idle speed can be increased by about every 100 min. -1 via the plug connection (upper illustration, 2).

The diagnosis plug is installed in the engine compartment on the firewall on the right (center illustration, 1).

Plug for CO adjustment (center illustration, 2).

If no CO tester is available with which it is possible to measure low CO values, make a plug connection for CO adjustment. The CO value is increased.

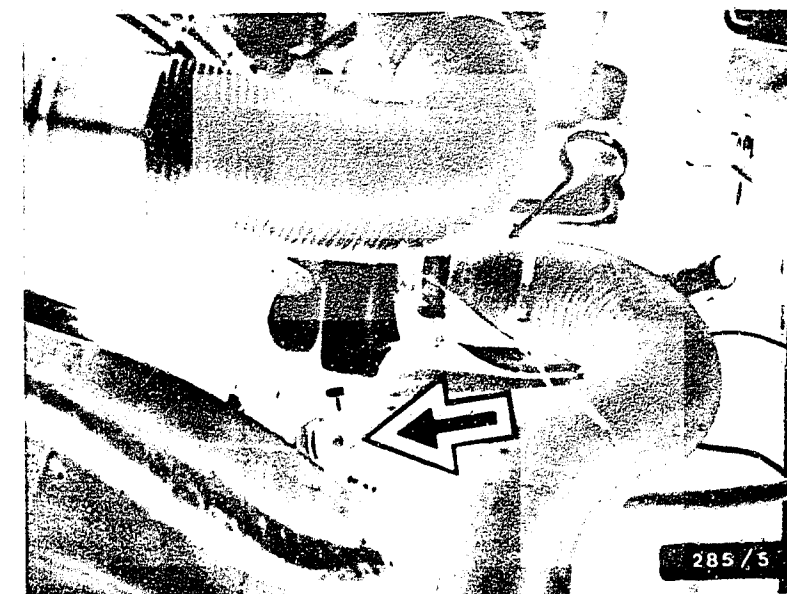
The warning and diagnosis lamp is installed in the instrument panel (lower illustration).



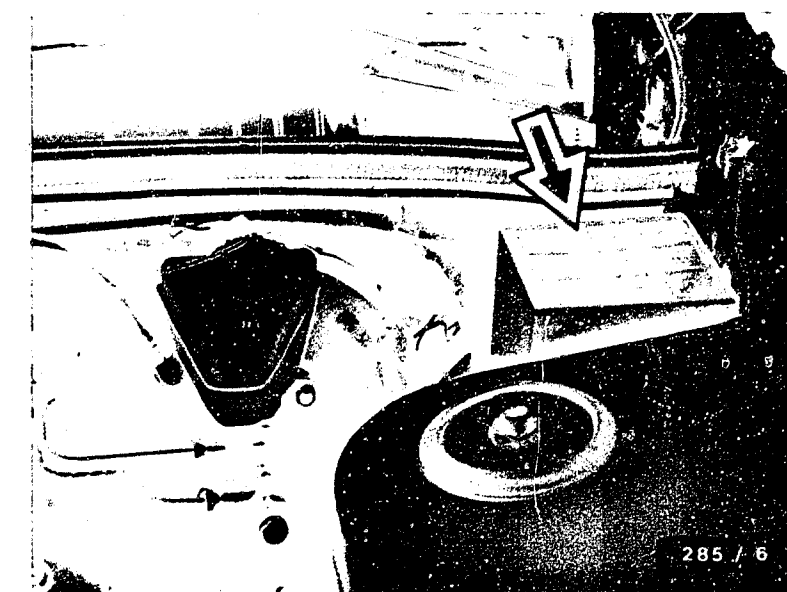
INSTALLATION POSITION OF COMPONENTS (continued)

The reference-mark and engine-speed sensor is mounted on the crankcase on the left as seen from the direction of travel (upper illustration, arrow).

The control relay and relay for intake-manifold preheating are installed beneath the cover (lower illustration, arrow).



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|-------------------------------|-------------------|
| Trouble-shooting instructions | : OPE-5002 |
| BOSCH system | : Ecotronic (2 Z) |
| Make of vehicle | : OPEL |
| Basic microcard | : PKW-047 |

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|--|------------|
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| Installation position of components..... | 15 |

SPECIAL FEATURES

- * This microcard contains the ECO2Z trouble-shooting instructions, valid at the time of publication, for the following Opel models:

Ascona/Kadett 1,8S (10.86 ->)
(with S 18 NV and E 18 NV engine)
- * Ecotronic with integral characteristic-map ignition (ECO2Z) with 35-pin control unit.
- * The control unit is equipped with self-diagnosis. If a fault should arise in the system, it is stored in the fault memory. At the same time, the warning/diagnosis lamp in the instrument panel lights up. If a sensor fails, the control unit operates with specified substitute values.

STRUCTURE, USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble-shooting chart leads to various causes/component faults.

Detailed instructions for trouble-shooting must be taken from the basic instructions via the trouble-shooting chart.

ATTENTION: Even if reference is made to basic instructions, the set values, terminal assignments and special features of these vehicle-related brief instructions are always binding.

Finding individual test steps in the brief and basic instructions is made easier through the use of identical test-step numbers.

SAFETY AND PRECAUTIONARY MEASURES

In order to keep persons out of danger and to prevent damage to the engine, control unit or ignition system, be sure to observe the safety and precautionary measures in the basic instructions.

*** C A U T I O N !**

High-performance ignition system.

Dangerous primary and secondary voltages.

Touching voltage-carrying components or terminals may prove fatal (both on the primary and secondary sides).

For further precautionary measures,
see basic instructions.

TROUBLE-SHOOTING CHART

Customer complaint (symptoms of trouble)

1. Starting motor operates, but engine fails to start or starts only with difficulty.
2. Engine starts but then dies.
3. Rough idling (engine speed, exhaust gas).
4. Poor throttle response, flat spot during acceleration.
5. Engine misfiring (ignition, fuel induction).
6. Maximum engine power/top speed not reached.
7. Fuel consumption too high.
8. Engine running on (dieseling).
9. Engine pinging/knocking.
10. Engine overheating.
11. Fault lamp.

| | Cause (component fault) |
|-------|------------------------------------|
| * * * | Evaluate self-diagnosis |
| * | Fault lamp defective |
| * * | Engine-speed/reference-mark sensor |
| * | Test primary side |
| * * | Test secondary side |
| * | Poor fuel quality |
| * | Fuel pressure |
| * | Fuel filter |
| * * | Choke-valve flap |
| * * | Float/float-needle valve |
| * * | Dirt in carburetor |
| * * | Intake system leaking |
| * * | Intake manifold heating |
| * * | Intake-air preheating |
| * | Alternator, interference-suppress. |
| * | Bypass heating |

Customer complaint (symptoms of trouble)

1. Starting motor operates, but engine fails to start or starts only with difficulty.
2. Engine starts but then dies.
3. Rough idling (engine speed, exhaust gas).
4. Poor throttle response, flat spot during acceleration.
5. Engine misfiring (ignition, fuel induction).
6. Maximum engine power/top speed not reached.
7. Fuel consumption too high.
8. Engine running on (dieseling).
9. Engine pinging/knocking.
10. Engine overheating.
11. Fault lamp.

| | | | | | | | | | | Cause (component fault) |
|--|---|---|---|---|---|---|---|--|--|-------------------------------------|
| | * | | | | | * | | | | Adjustment, throttle valve stage I |
| | * | * | * | * | * | | | | | Incorrect type of nozzle |
| | | * | | * | | | | | | Vacuum unit, stage II |
| | * | * | | * | | | | | | Adjustment, throttle valve stage II |
| | | * | | * | * | | | | | Adjustment, accelerator actuation |
| | * | | | | | | | | | Idle CO adjustment |
| | * | * | | | | | | | | Throttle valve worn |
| | | | | | | * | * | | | Test octane-rating adaptation |
| | * | | | | | | | | | Release and forced return |

For production reasons:
continued on the following
coordinate.

SELF-DIAGNOSIS TEST TABLE

| Fault indication Flash code | Testing of component/function | Test instructions/Test conditions | Termi- nals | Set values |
|--------------------------------|---|---|-----------------------|---|
| 1 2 | Control unit, diagnosis output | Control unit indicates that it is in the diagnosis mode. | 30 | — |
| 1 4 | Coolant-temperature sensor (short circuit to ground) | Resistance of temperature sensor: at 20°C at 80°C | 13 23 13 23 | 2...3 k Ω 280...360 Ω |
| 1 5 | Coolant-temperature sensor (open circuit) | | | |
| 2 2 | Throttle-valve potentiometer (short circuit to ground and/or open circuit) | Resistance, throttle-valve potentiometer and throttle-valve actuator (parallel): Wiper resistance, throttle-valve potentiometer: Run engine at idle. Seal off ventilating side of throttle-valve actuator. Switch off engine. Switch on ignition. Accelerator pedal in idle position: Accelerator pedal in full-load position: Resistance changes constantly between min. and max. | 9 6 9 7 9 7 | 0,7...1,3 k Ω min. less than 270 Ω max. 1,4...2,4 k Ω |
| 4 1 | Intake-manifold temperature (short circuit to ground) | Resistance of temperature sensor: at 20°C at 80°C | 22 23 22 23 | 2...3 k Ω 280...360 Ω |
| 4 3 | Intake-manifold temperature sensor (open circuit) | | | |
| 4 8 | Supply voltage too low | | 4 5 + - | greater than 10 V |
| 4 9 | Supply voltage too high | Test alternator/alternator regulator | 4 5 + - | less than 15 V |
| 5 1 | Control unit defective | After all faults have been read out. Clear fault memory. Run engine briefly. Repeat self-diagnosis output. If a fault is indicated again, replace the control unit. | — | — |

SELF-DIAGNOSIS TEST TABLE (Continued)

| Fault indication Flash code | Testing of component/functions | Test instructions/Test conditions | Terminals | Set values |
|--------------------------------|--|--|---------------------|--|
| 5 3 | Potentiometer in throttle-valve actuator (open circuit) | Resistance, throttle-valve potentiometer and throttle-valve actuator (parallel): Wiper resistance, potentiometer in throttle-valve actuator: (activate evacuating valve in throttle-valve actuator while testing and pull back throttle-valve actuator with hand vacuum pump.) Resistance decreases continuously. | 9 6 28 6 28 6 | 0,7...1,3 k Ω min. less than 400 Ω max. 1,4...2,6 k Ω |
| 5 4 | Potentiometer in throttle-valve actuator (short circuit to ground) | | | |
| 5 6 | Choke-valve actuator, current too high | Insulation resistance of choke-valve actuator: | 14 5 | greater than 1 M Ω |
| 5 7 | Choke-valve actuator, current too low | Winding resistance of choke-valve actuator: | 14 15 | 0,9...1,7 Ω |
| 5 8 | Input for CO adjustment (short circuit to ground) | Insulation resistance, input for CO adjustment: (adjustment plug disconnected) | 10 5 | greater than 1 M Ω |
| 5 9 | Throttle-valve actuator extends too slowly | Fault is indicated only if engine is running at idle during diagnosis output. | | |
| 6 1 | Throttle-valve actuator retracts too slowly | Switch off engine and check time it takes throttle-valve actuator to extend/retract: Retraction: Extension: | — — | max. 1 s max. 1 s |
| 6 2 | Ventilating valve in throttle-valve actuator | Insulation resistance, ventilating valve: Winding resistance, ventilating valve: | 34 5 34 35 | greater than 1 M Ω 20...70 Ω |
| 6 3 | Evacuating valve in throttle-valve actuator | Insulation resistance, evacuating valve: Winding resistance, evacuating valve: | 33 5 33 35 | greater than 1 M Ω 20...70 Ω |

TEST SPECIFICATIONS:

Idle speed: 830 ± 50 min-1
with idle-speed increase 930 ± 50 min-1

CO adjustment:
CO value with engine at normal operating temperature 0,2...0,3 % CO by vol.

With CO adjustment plug plugged in 0,5...1,5 % CO by vol.

Fuel pressure: 0,1...0,3 bar

Minimum fuel delivery (at 2000 min-1) 1 l/min

Float weight: 8,3 ± 0,3 g
Float height: 27,5 ± 1,0 mm
(Float level cannot be adjusted)

Throttle-valve potentiometer
Total resistance: 1,4...2,6 k Ω
Wiper resistance in correcting range: min. less than 270 Ω
max. 1,4...2,4 k Ω

Choke-valve actuator:
Winding resistance: 0,9...1,7 Ω

Basic setting, throttle valve Stage II: $a = 0.05 \pm 0,02$ mm

Release and forced return Stage II: $Y = 0,4 \pm 0,3$ mm
 $Z = 0,3 \pm 0,2$ mm

Tightening torques
Flange mounting 9 Nm

TEST SPECIFICATIONS (continued):

Throttle-valve actuator
evacuating valve (term.1/term.2): 20...70 Ω
ventilating valve (term.6/term.7): 20...70 Ω
Total resistance,
potentiometer (term.3/term.4): 1,4...2,6 k Ω
Wiper resistance in correcting range (term.5/term.3):
min. less than 400 Ω
max. 1,4...2,4 k Ω

Inductive engine-speed and reference-mark sensor:
Internal resistance 0,5...0,8 k Ω

Temperature sensor (NTC):
Internal resistance at 20°C: 2...3 k Ω
at 80°C: 280...360 Ω

Heating element, intake-manifold heating:
Internal resistance at 20°C: 0,6...0,7 Ω

Heating element, bypass heating:
Internal resistance at 20°C: 1,4...2,1 Ω

Type of nozzle:

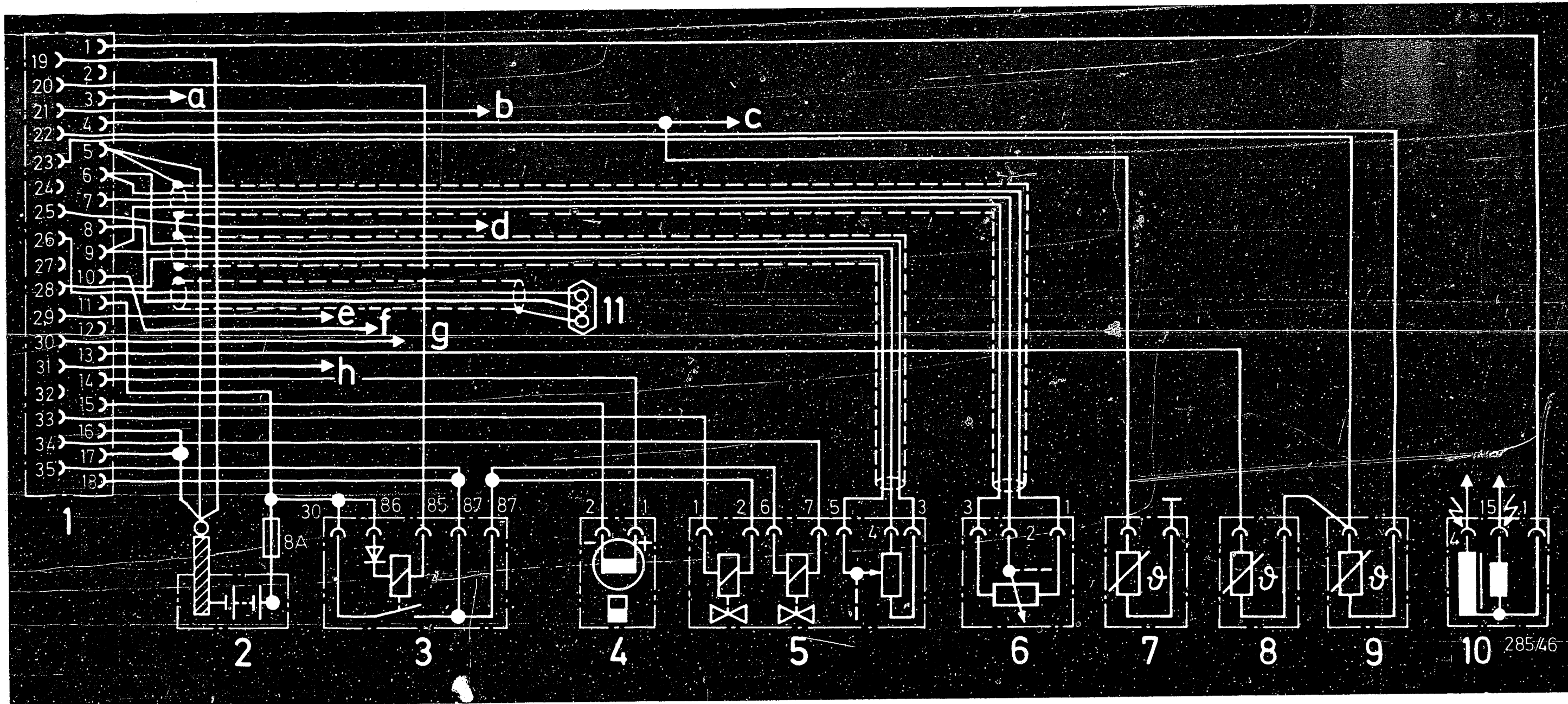
| | Stage 1 | Stage 2 |
|-----------------------|---------|---------|
| Main nozzle | x 110 | x 135 |
| Idle fuel nozzle | x 52,5 | |
| Air-correction nozzle | x 110 | x 70 |

Coding plug, octane-rating adaptation:

Resistance at:
91 RON: infinity Ohms
95 RON: 0 Ω

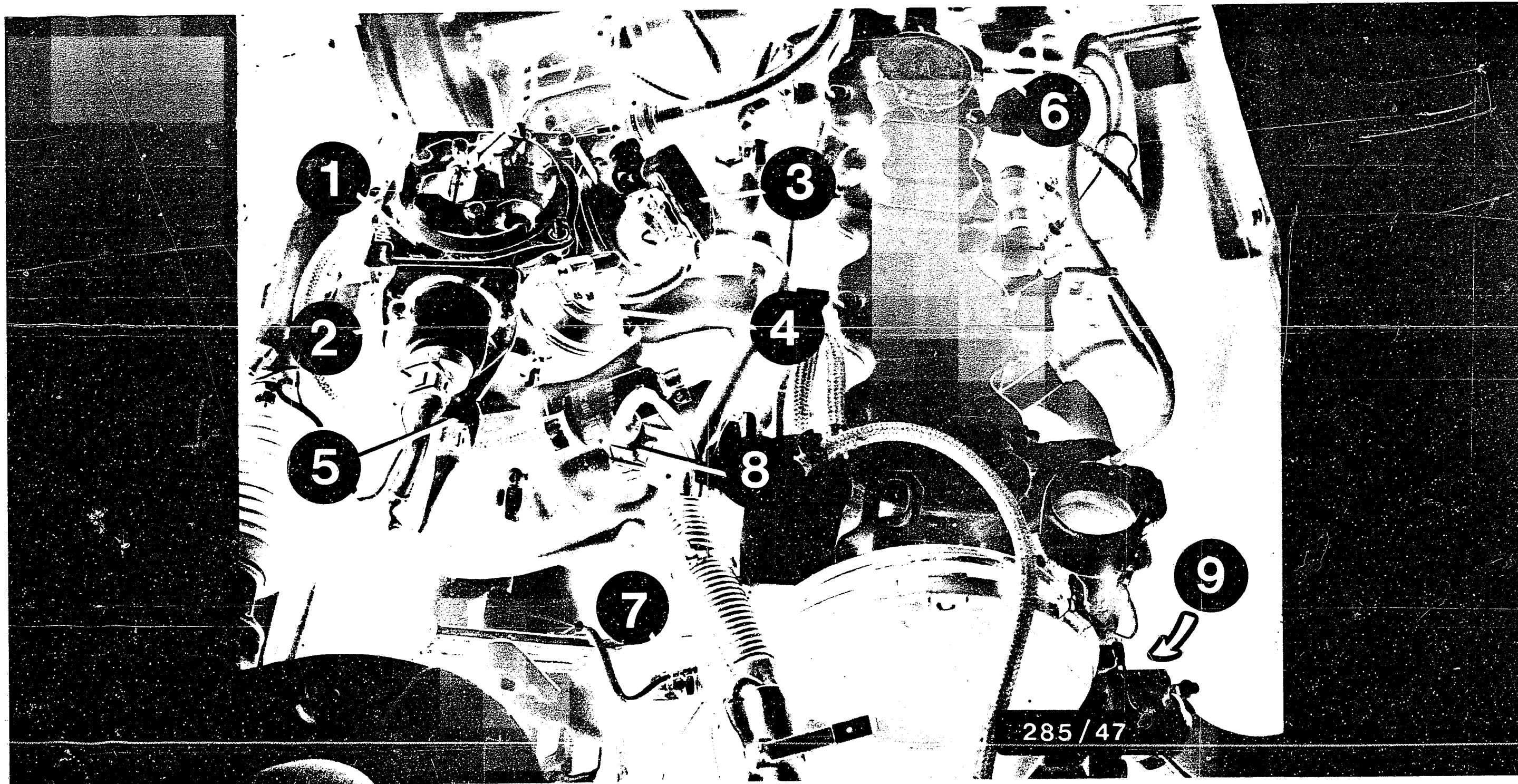
Voltage supply for potentiometer (throttle valve and throttle-valve actuator) and temperature sensor: 4,5...5,5 V

See equipment and Autodata microcards for the setting values for valve clearance and other engine-related data.



ELECTRICAL TERMINAL DIAGRAM

- | | | |
|---|----------------------------------|--------------------------------|
| 1 = Control unit, Ecotronic with ign. | 8 = Coolant-temperature sensor | e = Idle-speed increase |
| 2 = Battery | 9 = Intake-manifold temp. sensor | (with increase to ground) |
| 3 = Control relay | 10 = Ignition coil | f = Input for CO adjustment |
| 4 = Choke-valve actuator | 11 = Reference-mark sensor | g = Diagnostic lamp |
| 5 = Throttle-valve actuator | a = To intake-man. heating relay | h = Diagnosis stimulation lead |
| 6 = Potentiometer, main throttle valve (HD pot) | b = TD output | |
| 7 = Bypass heating element | c = To central electrics | |
| | d = Octane-rating adaptation | |



INSTALLATION POSITION OF COMPONENTS

- 1 = Carburetor
- 2 = Choke-valve actuator
- 3 = Throttle-valve actuator
- 4 = Vacuum unit stage 2

- 5 = Throttle-valve potentiometer
- 6 = High-voltage distributor
- 7 = Coolant-temperature sensor
- 8 = Intake-manifold temp. sensor
- 9 = Reference-mark sensor

INSTALLATION POSITION OF COMPONENTS (Continued)

The Ecotronic control unit with integral ignition is installed in the right-hand footwell beneath the cover (upper illustration). The cover has already been removed in the illustration. For the purpose of octane-rating adaptation, a coding loop has been installed in the wiring harness in vehicles with the S 18 NV engine (upper illustration, 1), and a coding plug has been installed in the engine compartment on the right-hand side behind the spring-strut dome in vehicles with the E 18 NV engine. The engine speed can be increased by approx. 100 min⁻¹ via this plug connection (upper illustration, arrow 2).

The diagnostic plug is located in the engine compartment on the right-hand side behind the spring strut (center illustration, 1). Plug for CO adjustment (center illustration, 2). If a CO analyzer with which small CO values can be measured is not available, create a plug connection for CO adjustment. CO value is increased.

Control relay and intake-manifold heating relay are installed on the firewall (center illustration, 3).

The warning and diagnostic lamp is installed in the instrument panel (lower illustration, arrow).

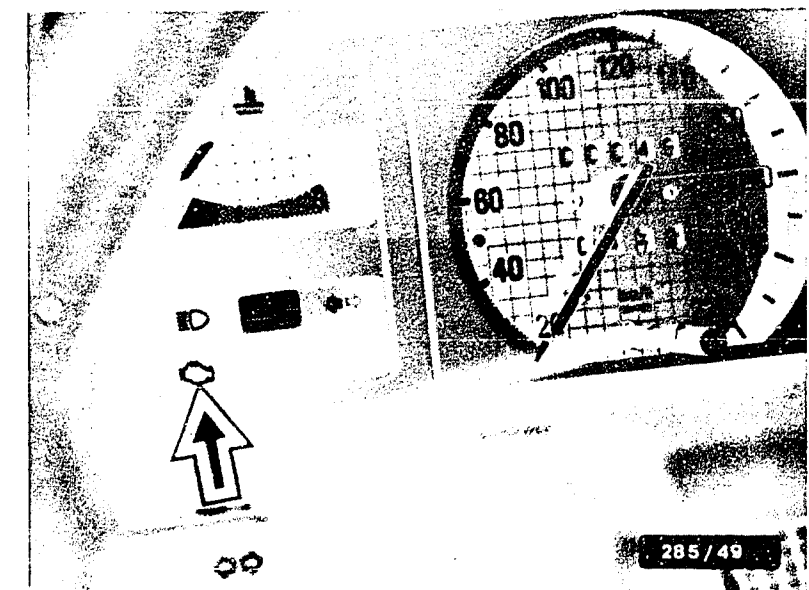
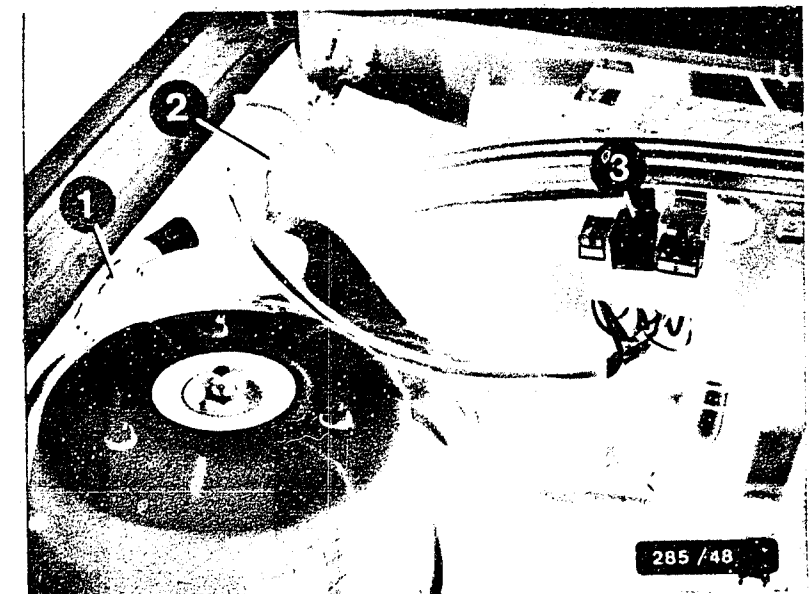
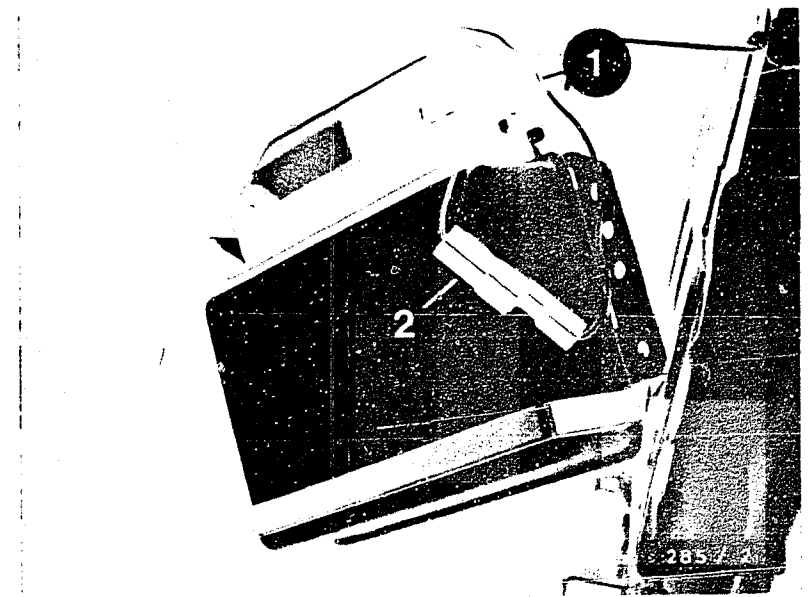


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Trouble-shooting instructions: VWV-5003

BOSCH system : Ecotronic (4.0)

Make of vehicle : VWV

Basic microcard : MB-530

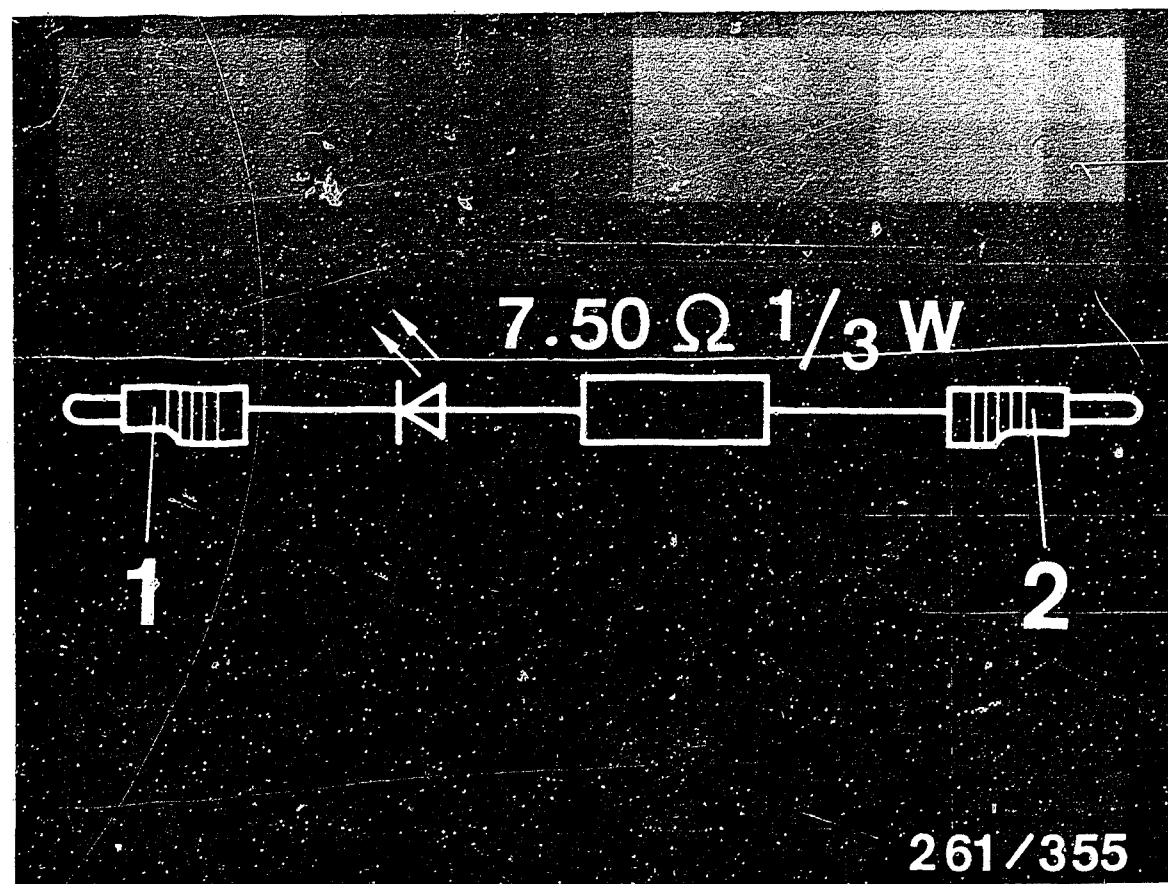
| Section | Coordinate |
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| Trouble-shooting chart..... | 05 |
| Rapid diagnosis chart for universal test adapter..... | 07 |
| Test specifications..... | 15 |
| Electrical terminal diagram..... | 17 |
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SPECIAL FEATURES

* This microcard contains the ECO 4.0 trouble-shooting instructions, valid at the time of publication, for the following VWmodels:

Golf 1,6 l and Passat 1,6 l
with manually shifted transmission
(03.87 ->)

- * Ecotronic with lambda closed-loop control (ECO 4.0) with 25-pin control unit.
- * If a sensor fails, the control unit operates with specified substitute values.
- * The system is similar to the Ecotronic (ECO 3), MB 190, 200 see SIS MB-530.



SPECIAL FEATURES (Continued)

In addition to the testers described in the basic instructions, another test lead (self-fabricated) is required for adjusting the lambda closed-loop control range (see illustration).

1 = Connection for LED at unassigned lead in engine compartment 2 = Connection for U_B

STRUCTURE, USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble-shooting chart leads to various causes/component faults. Detailed instructions for trouble-shooting must be taken from the basic instructions via the trouble-shooting chart.

ATTENTION: Even if reference is made to basic instructions, the set values, terminal assignments and special features of these vehicle-related brief instructions are always binding.

Finding individual test steps in the brief and basic instructions is made easier through the use of identical test-step numbers.

SAFETY AND PRECAUTIONARY MEASURES

In order to keep persons out of danger and to prevent damage to the engine, control unit or ignition system, be sure to observe the safety and precautionary measures in the basic instructions.

*** C A U T I O N !**
High-performance ignition system.
Dangerous primary and secondary voltages.

Touching voltage-carrying components or terminals may prove fatal (both on the primary and secondary sides).

For further precautionary measures, see basic instructions.

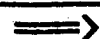
TROUBLE-SHOOTING CHART

Customer complaint (symptoms of trouble)

1. Starting motor operates, but engine fails to start or starts only with difficulty
2. Engine starts but then dies.
3. Rough idling
(engine speed, exhaust gas)
4. Poor throttle response,
flat spot during acceleration
5. Engine misfiring
(ignition, fuel induction)
6. Maximum engine power/
top speed not reached
7. Fuel consumption too high
8. Engine running on (dieseling)
9. Engine pinging/knocking.
10. Engine overheating.
11. Fault lamp

| Cause (component fault) | | | | | | | | | | |
|-------------------------|---|---|---|---|---|---|---|---|---|------------------------------------|
| * | * | * | * | * | * | * | * | * | * | Test with universal adapter |
| | | | | | | | | * | * | Fuel not to DIN |
| * | | | * | * | * | | | | | Fuel pressure outside tolerance |
| | * | | * | * | | | | | | Fuel delivery outside tolerance |
| * | * | * | * | * | * | * | | | | Choke-valve flap stiff |
| * | * | | | * | * | | | | | Float/float-needle valve |
| * | * | * | * | * | * | | | | | Dirt in carburetor |
| | * | * | * | * | * | | | | | Induction system leaking |
| | * | * | | | | | | | | Intake-manifold heating |
| | * | * | | | | | | | | Intake-air preheating |
| | * | | | | | | * | | | Adjustment, throttle valve stage I |
| | * | * | * | * | * | | | | | Incorrect nozzle type |
| | | * | | * | | | | | | Vacuum unit stage II |
| | * | * | | * | | | | | | Adjustment, throttle vlv. stage II |
| | | * | | * | * | | | | | Adjustment, accelerator actuation |
| | * | * | | | | | | | | Throttle valve worn |

K05



TROUBLE-SHOOTING CHART (continued)

Customer complaint (symptoms of trouble)

1. Starting motor operates, but engine fails to start or starts only with difficulty.
2. Engine starts but then dies.
3. Rough idling
(engine speed, exhaust gas)
4. Poor throttle response,
flat spot during acceleration.
5. Engine misfiring
(ignition, fuel induction)
6. Maximum engine power/
top speed not reached.
7. Fuel consumption too high.
8. Engine running on (dieseling).
9. Engine pinging/knocking.
10. Engine overheating.
11. Fault lamp.

| Cause (component fault) | | | | | | | | | | |
|-------------------------|---|---|---|---|---|---|---|---|---|----------------------------------|
| | * | | | | | | | | | Idle adjustment |
| | * | * | * | | | | | | | Bypass heating defective |
| | * | * | * | * | * | | | | | Exhaust-gas system defective |
| | * | * | * | * | * | | | | | Lambda sensor defective |
| | * | * | * | * | * | * | * | * | * | Test ignition system |
| | | * | * | | | | | | | Release/forced return, stage II. |

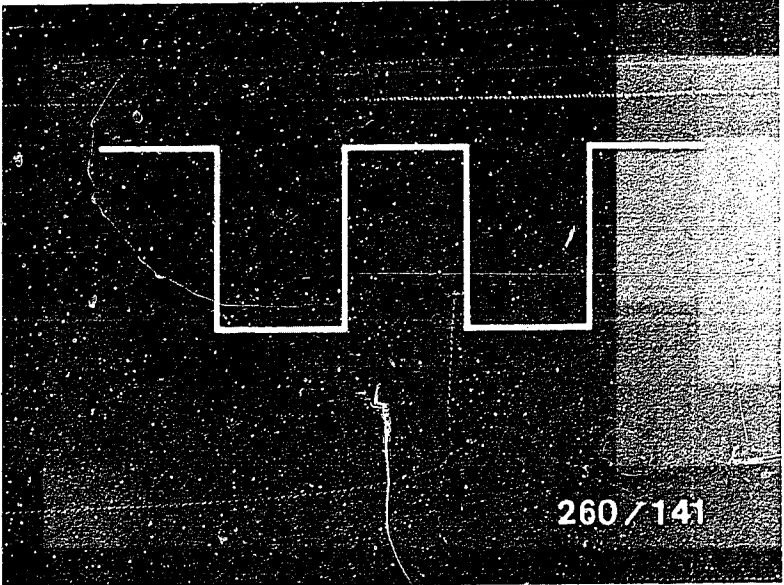
K06



RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01
 Adapter lead: 1 684 146 182

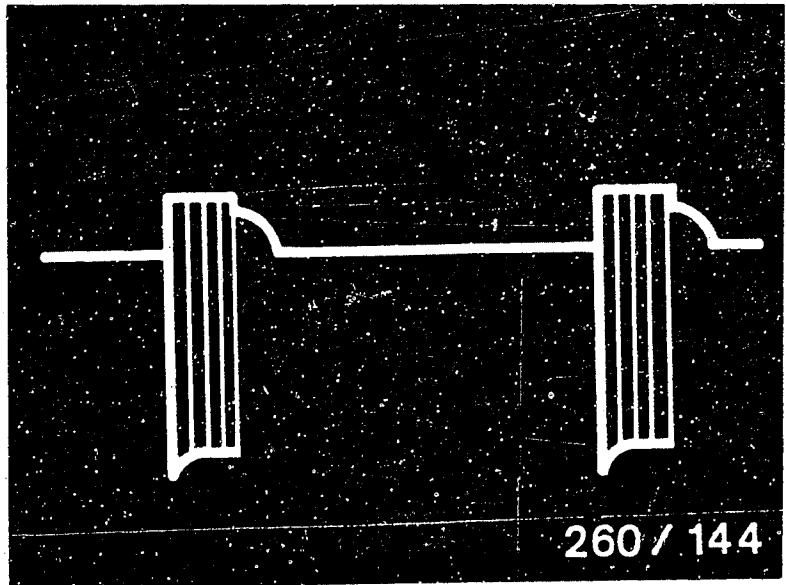
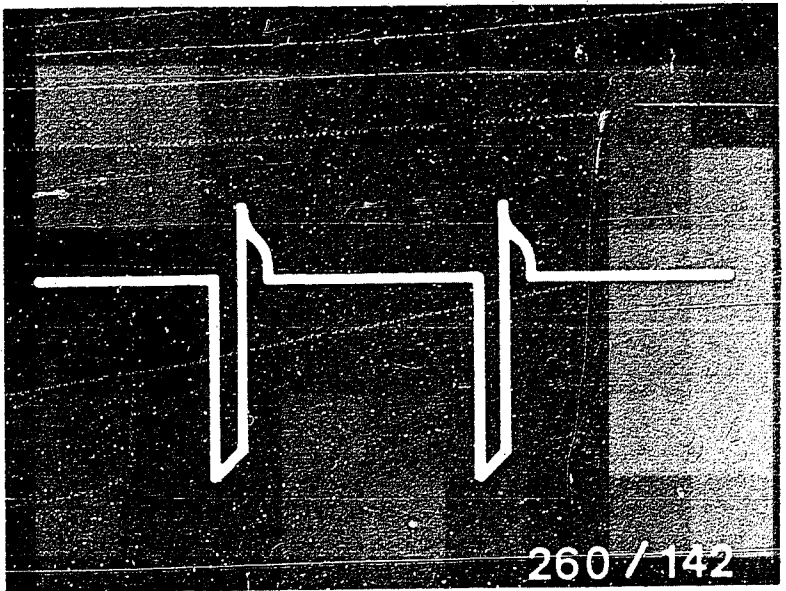
| Test step | Switch V | Ω | Testing of component/function | Test instructions/ Test conditions | Termi- nals | Set values |
|-----------|-------------|----------|---|--|----------------|--|
| 1 | V | 1 | Choke-valve actuator, insulation resistance | Make bridge, socket 1/socket 2 to universal test adapter. Ignition switched off, control unit not connected. | 12 2 | Greater than 1M Ω |
| 1.1 | V | 2 | Intake-manifold heating relay, winding resistance | | 14 2 | Less than 100 Ω |
| 2 | V | 3 | Choke-valve actuator winding resistance | | 12 10 | Less than 10 Ω |
| 3 | V | 9 | Coolant-temperature sensor | Set value is temperature-dependent: at + 20°C: at + 80°C: | 21 7 21 7 | 2...3 k Ω 280...360 Ω |
| 3.1 | V | 10 | Intake-manifold temperature sensor | Set value is temperature-dependent: at + 20°C: at + 80°C: | 5 7 5 7 | 2...3 k Ω 280...360 Ω |
| 4 | V | 7 | Ground cables, resistance | | 20 2 | Less than 10 Ω |
| 4.1 | V | 12 | Solenoid-operated valve, evacuating, in throttle-valve actuator, insulation resistance | | 9 2 | Greater than 1 M Ω |
| 4.2 | V | 13 | Solenoid-operating valve, ventilating, in throttle-valve actuator, insulation resistance | | 3 2 | Greater than 1M Ω |
| 5 | V | 17 | Solenoid-operated valve, evacuating, in throttle-valve actuator, winding resistance | | 9 23 | 20...80 Ω |
| 6 | V | 18 | Solenoid-operated valve, ventilating, in throttle-valve actuator, winding resistance | | 3 23 | 20...80 Ω |
| 8 | V | 20 | Resistance, potentiometers, throttle-valve actuator and throttle valve | Potentiometers are connected in parallel | 18 7 | 0,7...1,3 k Ω |

| Test step | Switch V | Ω | Testing of component/function Test instructions/conditions | Termi- nals | Set values |
|-----------|-------------|----------|---|----------------|--|
| 10 | 3 | 20 | Supply voltage, control unit (Control unit connected) | 1 2 | Greater than 10 V |
| 10.1 | 4 | 20 | Switch on ignition. Voltage supply of solenoid-operated valves in throttle-valve actuator. | 23 2 | Greater than 10 V |
| 11 | 5 | 20 | Connect ignition oscilloscope with black clip to black measuring recess and with red clip to red measuring recess of universal test adapter. Engine is running and at normal operating temperature. Measurement of engine-speed signal and pulses during starting procedure. | 25 2 | See upper illustration |
| 12 | 6 | 20 | Voltage supply term.15 | 13 2 | Greater than 10 V |
| 13 | 7 | 20 | Supply voltage for potentiometers (throttle valve and throttle-valve actuator) | 18 2 | 4,5...5,5 V |
| 14 | 8 | 20 | Voltage supply, hedgehog-heating relay in intake manifold | 14 2 | Greater than 10 V |
| 16 | 10 | 20 | Test throttle-valve actuator: remove bridge socket 1/socket 2 at universal test adapter. Press push-button T3 at universal test adapter. Rod of throttle-valve actuator moves into overrun position. Engine dies. Value may change a max. of 0,2 V within 30 seconds. | 17 2 | 0,1...0,8 V ↓ V After approx. 30 s. + max. 0,2 V |



RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 Continued
Adapter lead: 1 684 146 182

| Test step | Switch V | Ω | Testing of component/function Test instructions/conditions | Termi- nals | Set values |
|-----------|-------------|----------|---|----------------|---|
| 17 | 11 | 20 | Test throttle-valve potentiometer: slowly push accelerator pedal to floor. Voltage value increases continuously between min. and max. . | 11 2 11 2 | Min: 0,05...0,6 V Max: 4,2...5,5 V |
| 18 | 10 | 20 | Test throttle-valve actuator (ventilating side): Apply lead from socket 2 at universal test adapter 1 s. to ground (e.g. black measuring recess). <u>Attention:</u> under no circumstances allow socket 1 at universal test adapter to make contact with positive (e.g. red measuring recess) | 17 2 | 0,3...1,0 V After 1 s. ↓ V 2,8...4,2 V |
| 19 | 12 | 20 | Measurement of signal for choke-valve actuator: Make bridge socket 1/socket 2 at universal test adapter. Start engine. | 12 2 | See upper illustration |
| 20 | 12 | 20 | As 19, however, signal becomes wider when push-button T5 at universal test adapter is pressed (simulation, cold engine) | 12 2 | See lower illustration |
| 21 | 12 | 20 | Acceleration enrichment: Briefly actuate accelerator pedal. Signal becomes wider. | 12 2 | See lower illustration |
| 23 | 13 | 20 | Actuation of ventilating valve in throttle-valve actuator: Switch off ignition. Then pay attention to time and voltage value! | 3 2 3 2 | Greater than 10 V after approx. 5...20 s Less than 1 V |



RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 Continued
Adapter lead: 1 684 146 182

| Test step | Switch | | Testing of component/function Test instructions/conditions | Termi- nals | Set values |
|-----------|--------|----------|--|-------------------|---|
| | V | Ω | | | |
| 24 | 14 | 20 | Start engine. Actuation of evacuating valve in throttle-valve actuator: Switch on ignition. Then pay attention to time and voltage value! | 9 2 9 2 9 2 | Less than 1 V after approx. 12 s Greater than 10 V after further approx. 3 s Less than 1 V |
| 26 | 23 | 20 | Lambda closed-loop control, open-loop control value at test output. Connect test lead with LED to unassigned lead in engine compartment. Engine runs and has normal operating temperature | 6 2 | LED flashes at high frequency |
| 27 | 23 | 22 | Lambda closed-loop control, rich value at test output | 6 2 | LED goes out |
| 28 | 23 | 23 | Lambda closed-loop control, lean value at test output | 6 2 | LED lights up |
| 29 | 23 | 24 | Lambda closed-loop control, closed-loop control value at test output | 6 2 | LED flashes at approx. 2 Hz |
| 29.1 | 18 | 20 | Transmission identification Vehicles with manually shifted transmission: Vehicles with automatic transmission: | 16 2 16 2 | Approx. 0...5 V Greater than 6 V |
| 31 | — | — | Test CO value. Connect CO analyzer to exhaust-sample pipe in front of the catalytic converter. (Hose for crankshaft ventilation disconnected; lead to lambda sensor disconnected). | — | % CO by vol. |

TEST SPECIFICATIONS:

Idle speed: 900 ± 75 min⁻¹

Adjust lambda closed-loop-control range:

Run engine to warm up until at normal operating temperature (approx. 80°C). Increase engine speed for 30 s. to greater than 2000 min⁻¹, so that the lambda sensor is sure to be at normal operating temperature. Afterwards, immediately connect test lead to unassigned lead in engine compartment and to battery term.30. Run engine at idle. LED of test lead must flash at approx. 1,5 Hz. If necessary, adjust at idle-mixture-adjusting screw.

Exhaust-gas adjustment:
Test CO value with engine at normal operating temperature (in vehicles with lambda closed-loop control, test at sampling pipe before catalytic converter): 0,2...1,0 %CO by vol.

Fuel pressure: 0,1...0,3 bar

Minimum fuel delivery
(at 2000 min⁻¹) 1 l/min

Float weight: 7,9 ± 0,5 g
Float height: 27,5 ± 1,0 mm
(Float cannot be adjusted)

Throttle-valve potentiometer
Total resistance: 1,4...2,6 k Ω
Wiper resistance in correcting range: min. less than 270 Ω
max. 1,4...2,4 k Ω

Choke-valve actuator:
Winding resistance: 0,9...1,7 Ω

Basic setting, throttle valve
Stage I (with feeler gauge) 3,15 ± 0,1 mm
Stage II a = 0,03 ± 0,02 mm

TEST SPECIFICATIONS (continued):

Release and forced return
Stage II: Y = 1,0 ± 0,2 mm
Z = 0,4 ± 0,2 mm

Winding resistance, intake-manifold heating relay: 20...50 Ω

Throttle-valve actuator
Evacuating valve (term.1/term.2): 20...70 Ω
Ventilating valve (term.6/term.7): 20...70 Ω
Total resistance, potentiometer (term.3/term.4): 1,4...2,6 k Ω
Wiper resistance in correcting range (term.5/term.3): min. less than 400 Ω
max. 1,4...2,4 k Ω

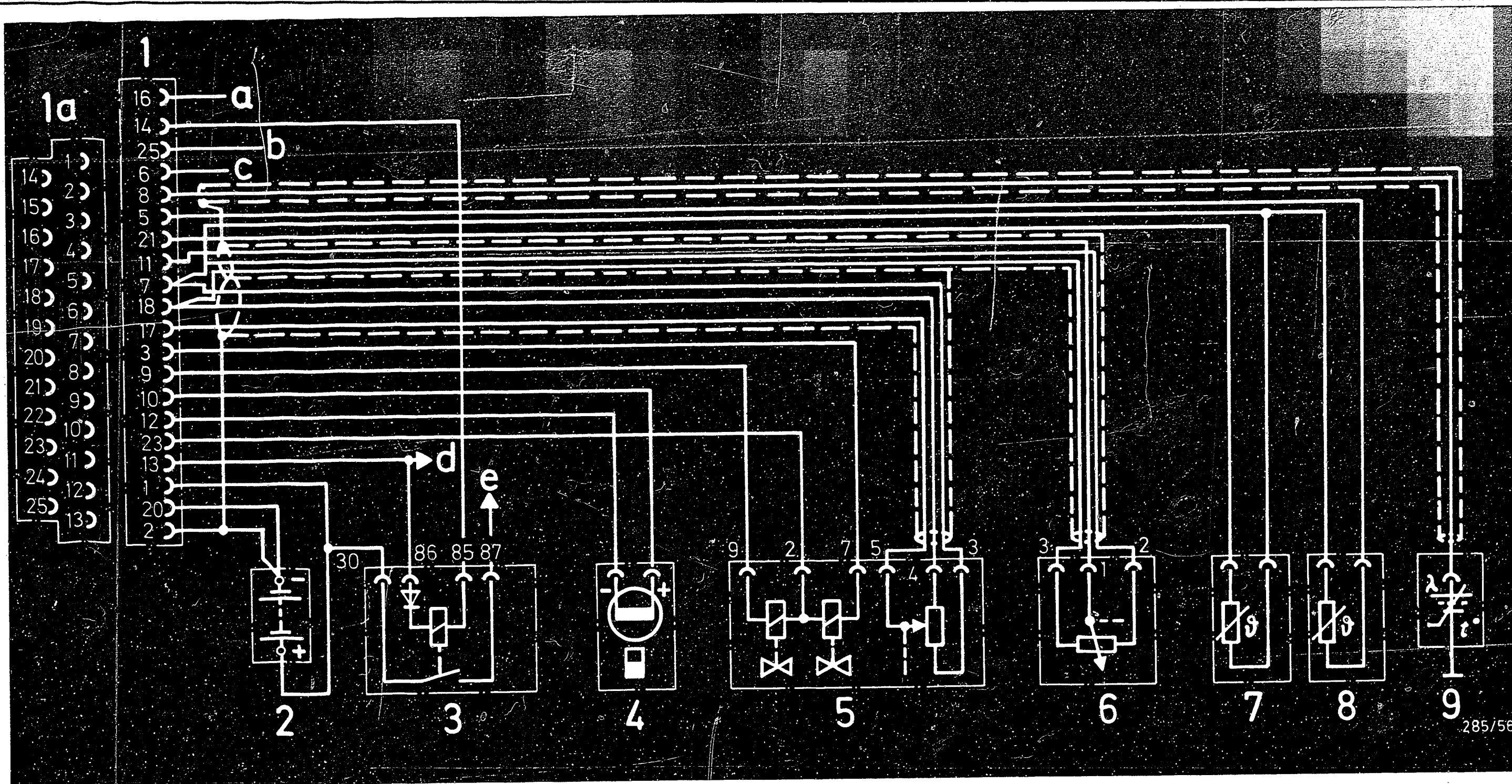
Temperature sensor (NTC):
Internal resistance at 20°C: 2,0...3,0 k Ω
at 80°C: 280...360 Ω

Heating element, intake-manifold heating:
Internal resistance at 20°C: approx. 1,5 Ω

| Type of nozzle: | Stage 1 | Stage 2 |
|--|---------|---------|
| Main nozzle | x 105 | x 110 |
| Idle fuel nozzle | x 45 | |
| Acceleration fuel nozzle | | 90 |
| Air correction nozzle (with mixing tube) | x 110 | x 105 |
| Acceleration air nozzle | | x 130 |
| Full-load enrichment | | 100±10 |

Tightening torques
Carburetor mounting 7 Nm
Flange mounting 13 Nm

See equipment and Autodata microcards for setting values for valve clearance and other engine-related data.



Electrical terminal diagram of the Ecotronic

1 = Control unit, Ecotronic

1a = Plug assignment

2 = Battery

3 = Relay, intake-manifold heating

4 = Choke-valve actuator

5 = Throttle-valve actuator (DKA)

6 = Potentiometer, main throttle valve

7 = Coolant-temperature sensor

8 = Intake-manifold temp. sensor

9 = Lambda sensor

a = Transmission identification

b = Td Signal

c = Unassigned lead for setting the control range of the lambda sensor

d = Term. 15

e = To heating element, intake-manifold heating

Trouble-shooting instructions: AUD-5001

BOSCH system : K - Jetronic
Vehicle make : AUDI
Basic microcard : VWV-504

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| Installation position of components | 15 |

SPECIAL FEATURES

These trouble-shooting instructions apply to the following Audi models, valid at the time of compilation:

- * AUDI 80 GTE 01.86 ->
Engine DZ, MU / 1.8 ltr./ 4 cyl.
K-Jetronic
- * Updraft mixture-control unit
- * Air-shrouded injection valves
- * Pressure-operated snap-action switch for cold-acceleration enrichment
- * Idle-speed-increase valve 1 for increasing engine speed when idle speed falls below approx. 700 min⁻¹ . .
- * Idle-speed-increase valve 2 for increasing engine speed when air conditioner is switched on (if fitted).

Important note: if reference is made to a basic micro-card, be sure always to take the test specifications from the vehicle-specific brief instructions.

SAFETY AND PRECAUTIONARY MEASURES

Be sure to observe safety and precautionary measures so as to avoid risk to persons and to prevent damage to the engine, trigger boxes, control units or the ignition system.

CAUTION!

High-energy ignition system with dangerous high and low voltages!

Touching live parts or terminals may be highly dangerous (both on the primary and secondary sides).

TROUBLE-SHOOTING CHART

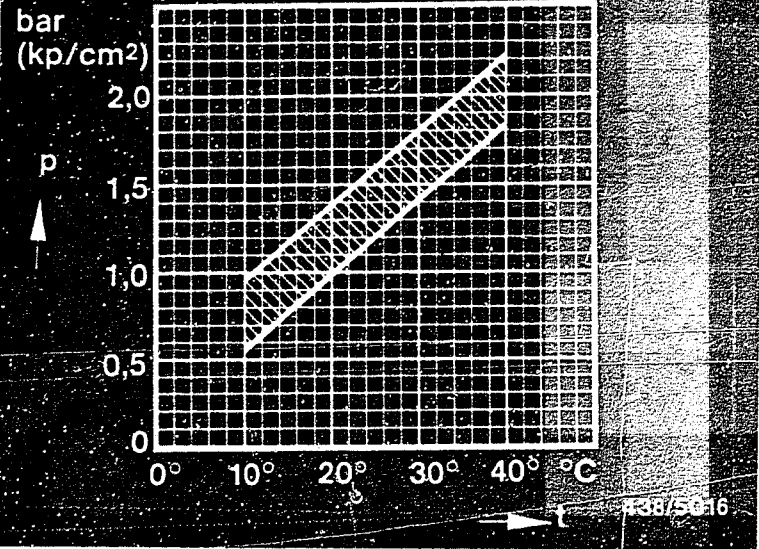
Customer complaint (fault symptoms)

1. Starting motor operates, but engine fails to start or starts only with difficulty.
2. Engine starts but then dies.
3. Rough idling (engine speed, exhaust gas).
4. Poor throttle take-up, flat spot during acceleration.
5. Misfiring (ignition, fuel injection).
6. Maximum engine power/top speed not reached.
7. Fuel consumption too high.
8. Engine running on (dieseling).
9. Engine pinging/knocking.
10. Engine becomes too hot.
11. Fault lamp.

| | | | | | | | | Cause (component fault) |
|---|---|---|---|---|---|---|---|--------------------------|
| * | * | | | * | | | | Electric fuel pump |
| * | | * | * | | * | | | Air-intake system |
| * | | | | | | | | Fuel system |
| * | | * | * | | * | | * | Fuel distributor |
| * | | * | * | * | * | | * | Air-flow sensor |
| * | | * | | | | * | * | Cold-start system |
| * | | * | | * | | | * | Injection valves |
| | * | | | * | * | | | Primary pressure |
| * | * | * | * | * | * | * | | Control pressure |
| * | | * | * | | * | | | Fuel-delivery dispersion |
| | | | | | * | | | Throttle valve |
| * | | * | | | | | | Auxiliary air device |
| * | | * | * | | | * | * | Basic idle setting |

TEST SPECIFICATIONS

| No. | Testing/Test condition | Set specification |
|-----|--|---|
| 1 | Electric fuel pump – fuel delivery: Supply voltage (under load): | at least 1500 cm ³ /min at least 11,5 V |
| 2 | Fuel delivery – control–pressure circuit: | 160...240 cm ³ /min |
| 3 | Fuel distributor – system pressure: Test specification: Setting: | 5,2...5,9 bar 5,4...5,6 bar |
| 4 | Control pressure: Take control pressure "cold" from the chart opposite corresponding to the ambient temperature measured. Control pressure "warm": | 3,4...3,8 bar |
| 5 | Leakage test – total system: Minimum pressure after 10 mins.: Minimum pressure after 20 mins.: | 3,4 bar 3,3 bar |
| 6 | Injection valves – opening pressure: Leakage test at not below 3,5 bar: No drop must fall within 25s. | 3,7...4,8 bar |

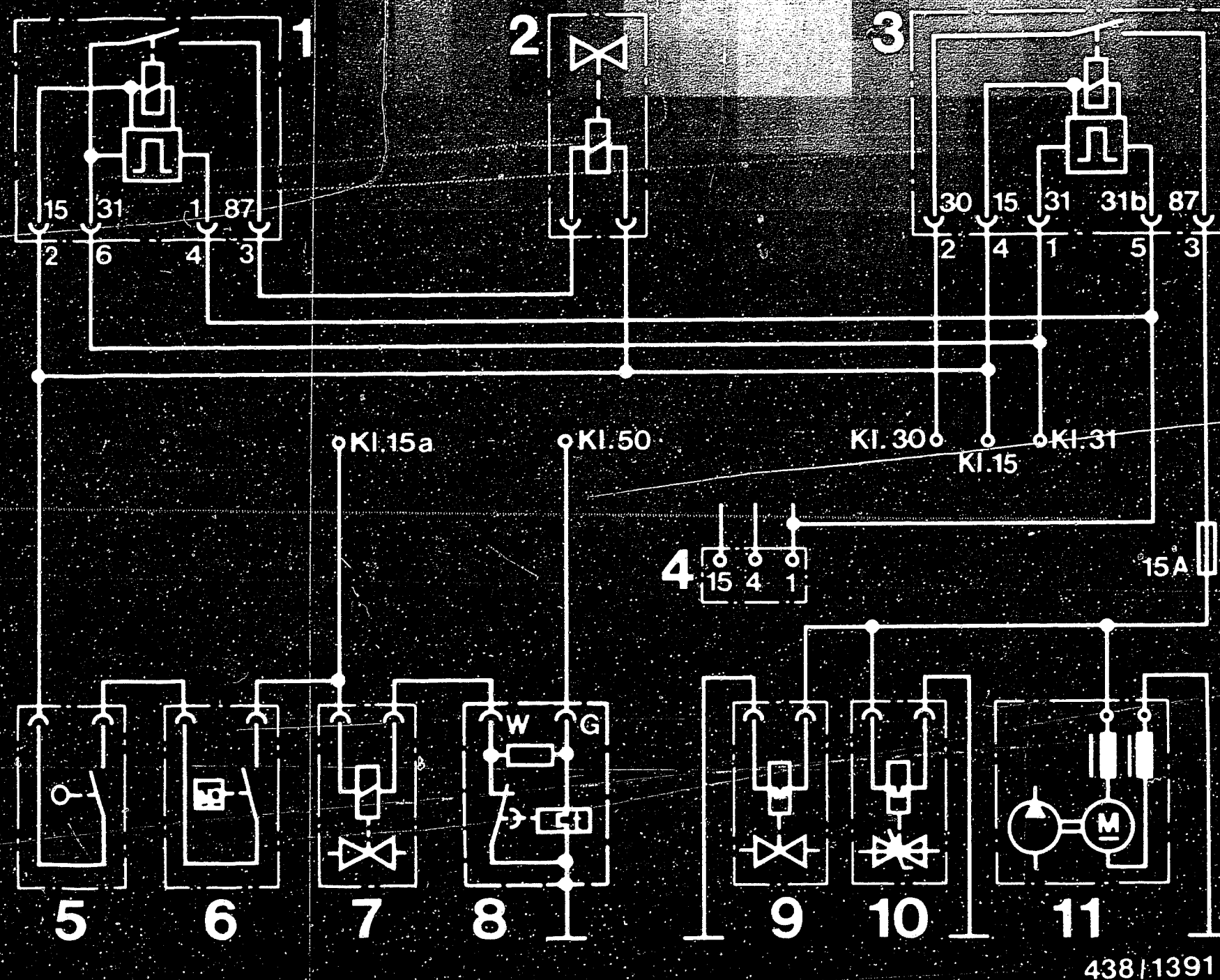


p = Contr. press. (overpress.)
t = Ambient temperature

TEST SPECIFICATIONS (CONTINUED)

| No. | Testing/Test condition | Set value | |
|-----|---|--|--|
| 7 | Fuel deliveries - comparative measurement: | Setting point: (cm ³ /min) | Max. permis. flow: (cm ³ /min) |
| | Idle: | 6,0 | 6,6 |
| | Part load: | 40,0 | 43,0 |
| | Full load: | 110,0 | 120,0 |
| | Minimum flow at max. deflection of air-flow sensor plate: | 110 cm ³ /min | |
| 8 | Thermo-time switch - resistance measurement: | Below + 30° C Above + 40° C | |
| | Terminal G and ground: | 25...40 Ω | 50...80 Ω |
| | Terminal W and ground: | 0 Ω | 100...160 Ω |
| | Terminal G and terminal W: | 25...40 Ω | 50...80 Ω |
| 9 | Idle adjustment* | | |
| | Idle speed: | 800...1000 min ⁻¹ | |
| | CO content: | 0,5...1,5 % by vol. | |

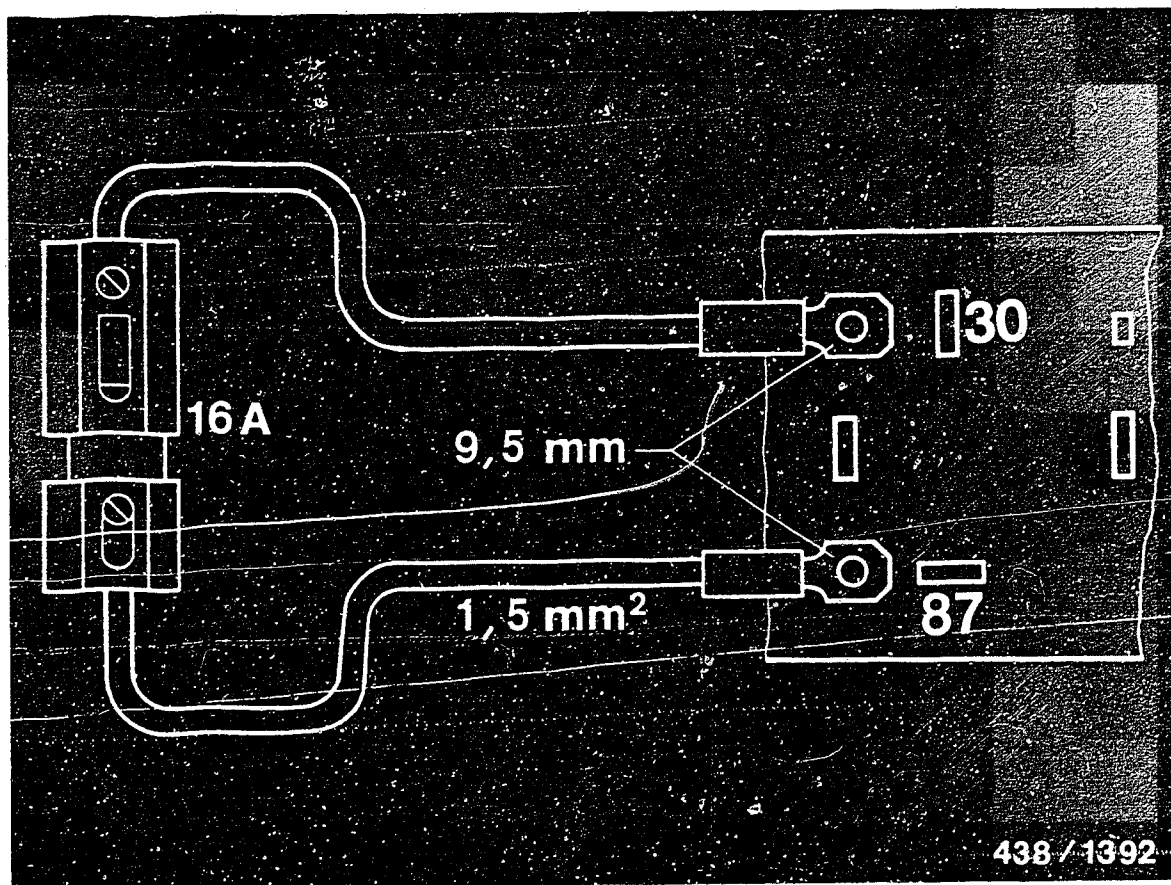
* Notes on idle adjustment:
 Engine-oil temperature must be a minimum of 80 °C.
 Hose for crankcase ventilation disconnected and routed so that only fresh air can be inducted.
 Hose to idle-speed increase valve clamped.
 All electrical loads switched on.
 Fan of radiator must not be running.



- 1 = Control unit, idle-speed increase
- 2 = Idle-speed-increase valve
- 3 = Electronic relay
- 4 = Ignition coil
- 5 = Throttle-valve switch
- 6 = Pressure-operated snap-action switch

- 7 = Start valve
- 8 = Thermo-time switch
- 9 = Warm-up regulator
- 10 = Auxiliary-air device
- 11 = Electric fuel pump

ELECTRIC TERMINAL DIAGRAM WITH SAFETY CIRCUIT FOR ELECTRIC FUEL PUMP



BRIDGING THE SAFETY CIRCUIT

Remove electronic relay from plug-in base. Connect contact 87 to contact 30 in the plug-in base with a bridge. Use a 1.5 mm² connecting cable with fuse link and 16 amp fuse.

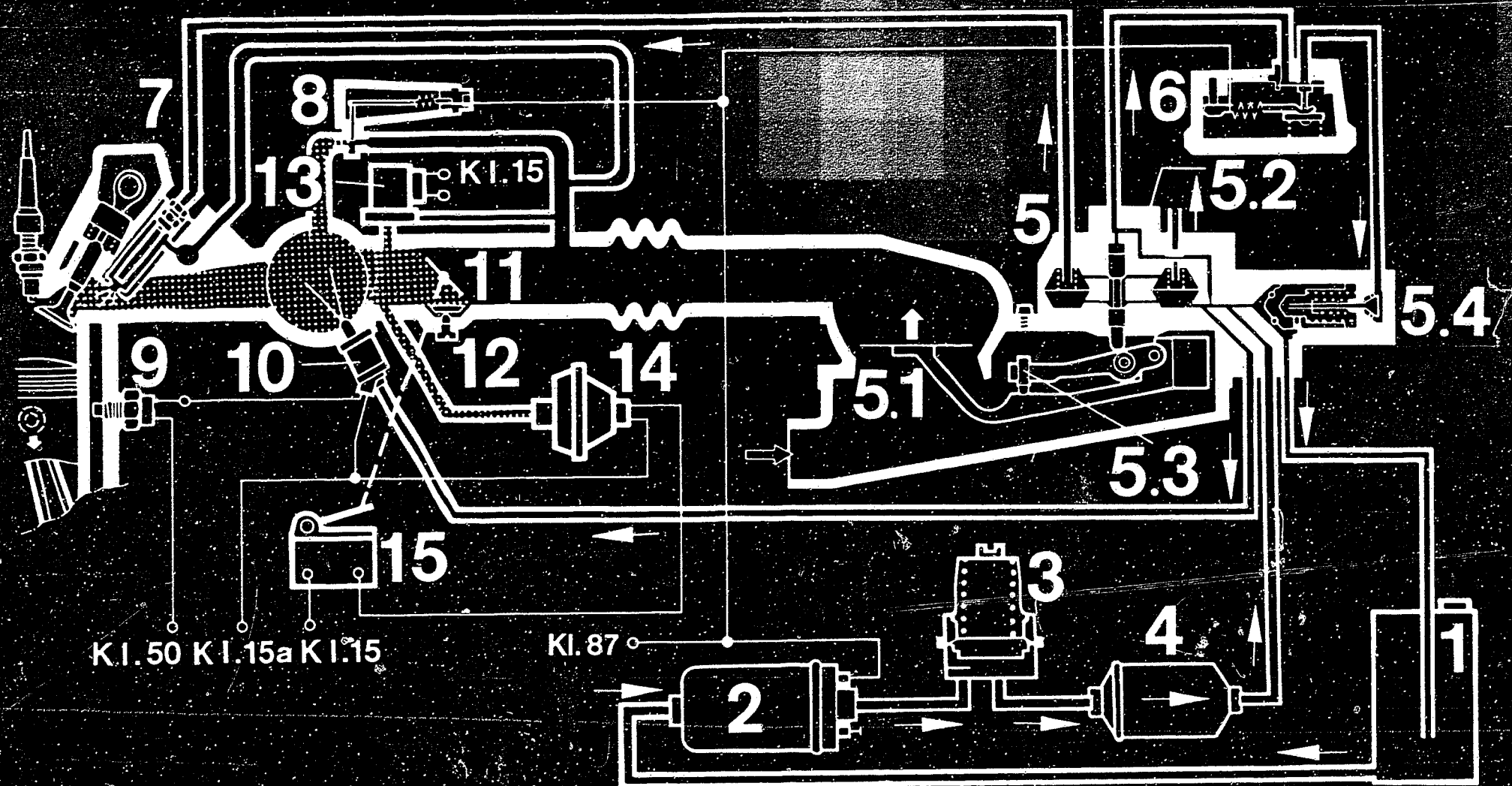
In this way, battery voltage is supplied to the electric fuel pump, auxiliary-air device and warm-up regulator.

C a u t i o n :

Never deflect (raise) the sensor plate with the electric fuel pump running, since fuel is then injected via the injection valves.

Subsequent operation of the starting motor can lead to major damage to the engine.

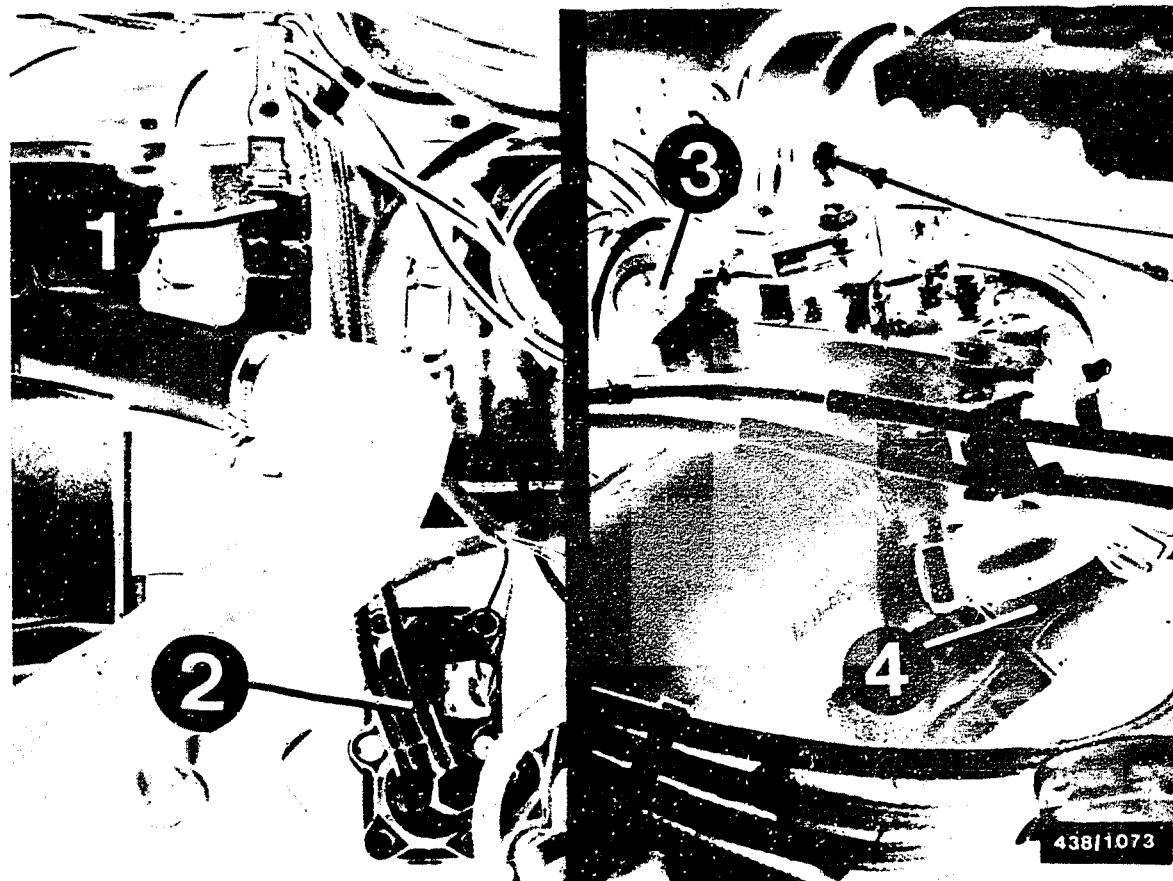
For production reasons:
continued on the following
coordinate.



- 1 = Fuel tank
- 2 = Electric fuel pump
- 3 = Fuel accumulator
- 4 = Fuel filter
- 5 = Mixture-control unit
- 5.1 = Air-flow sensor
- 5.2 = Fuel distributor
- 5.3 = Idle-mixture-adjusting screw
- 5.4 = Primary-pressure regulator
- 6 = Warm-up regulator

- 7 = Injection valve
- 8 = Auxiliary-air device
- 9 = Thermo-time switch
- 10 = Start valve
- 11 = Throttle valve
- 12 = Idle-speed bypass screw
- 13 = Idle-speed-increase valve
- 14 = Pressure-operated snap-action switch
- 15 = Throttle-valve switch

DIAGRAM OF AIR/FUEL LINES



- 1 = Thermo-time switch
- 2 = Warm-up regulator
- 3 = Start valve
- 4 = Auxiliary-air device

For production reasons:
continued on the following
coordinate.

INSTALLATION POSITION OF COMPONENTS

- * Electric fuel pump, fuel accumulator,
fuel filter:
on the floor of the vehicle over the rear axle.
- * Electronic relay:
in the central electrics console, to the left beneath
the instrument panel.
- * Idle-speed-increase valve:
in the engine compartment on the firewall, next to
the battery.
- * Pressure-operated snap-action switch:
in the engine compartment on the firewall, next to
the ignition coil.

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SPECIAL FEATURES

- * This microcard contains the ECO 4.0A trouble-shooting instructions, valid at the time of publication, for the following Audi-model:
Audi 80 (04.87 ->)
(with 1,6 l engine)
Engine code letter: pp
- * Ecotronic (ECO 4.0A) with 25 -pin control unit.
- * The control unit is equipped with self-diagnosis. Should a fault occur in the system, this fault is stored in the fault memory and may be read out by the diagnostic lamp in the instrument panel.
If a sensor fails, the control unit operates using specified substitute values.
- * The ventilating valve in the throttle-valve actuator is supplied with filtered air via an additional filter (built on to the air filter).
- * The system is similar to the Ecotronic (ECO 3), Mercedes-Benz
See SIS MB-530.

SPECIAL FEATURES (continued):

The control range of the lambda closed-loop control system is indicated by means of the fault lamp installed.

Test and adjust the lambda closed-loop control range:

Correct adjustment of the lambda closed-loop control range is indicated by flashing pulses of the fault lamp.

Triggering the indicator:

- Switch off the ignition for at least 20 s.
 - Bridge contacts A, B to relay of intake-manifold heater using fuse.
 - Start engine and run at idle for at least 4 s.
 - Remove fuse.
 - Run engine until lambda sensor reaches normal operating temperature; to do this, increase engine speed for 1 mins to above 2000 up to max. 3500 min⁻¹.
- Note: if the engine speed is increased to above 4000 min⁻¹, the indication is cleared; retrigger the indicator.

Lambda closed-loop control in control range:
fault lamp flashes 1,5 times per second.

Lambda closed-loop control at rich stop:
fault lamp lights up constantly.

Lambda closed-loop control at lean stop:
fault lamp does not light.

Adjust control range via idle-mixture-adjusting screw (upper illustration, arrow).

Note: fault lamp flickers (25 times per second)

- lambda sensor not at normal operating temperature
- break in lead to lambda sensor.

Check activated-carbon-filter valve for leaks:

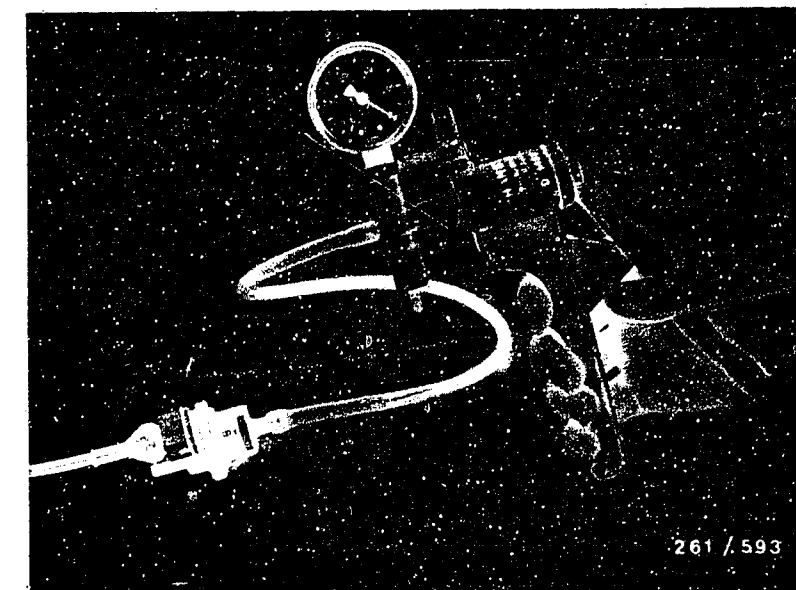
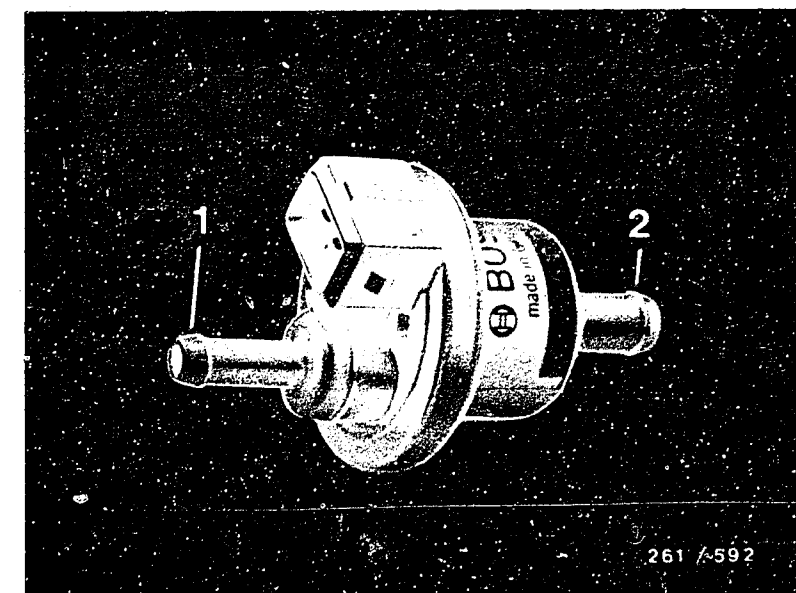
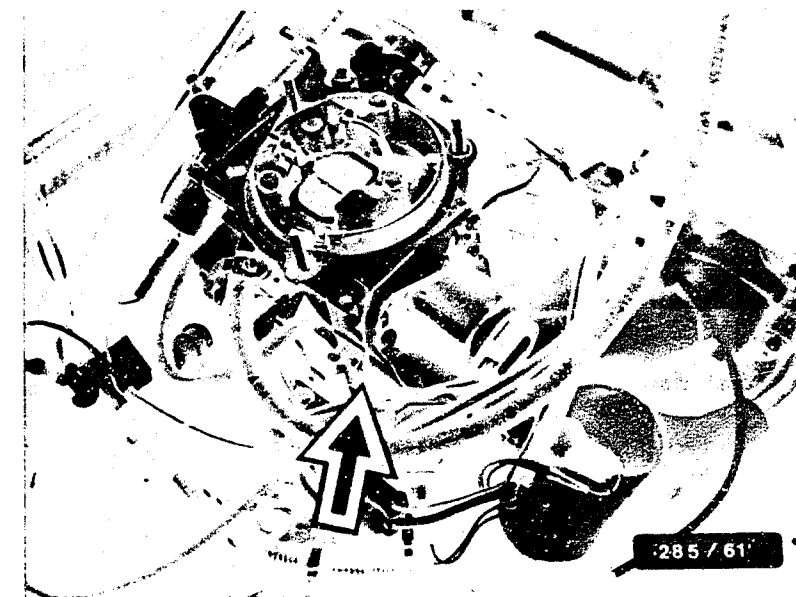
Remove activated-carbon-filter valve.

Connect vacuum pump (e.g. Mityvac) to the connection of the valve on the intake-manifold side (center illustration, 2).

1. Valve deenergized → opening (no vacuum build-up possible).
2. Trigger valve with battery voltage (10...15 V) (use connecting cable KDJE-7450/70) (lower illustration).

Generate vacuum of approx. 0,5 bar.

Permissible pressure drop: 0,25 bar in 10 s.



TROUBLE-SHOOTING CHART (continued)

- Customer complaint (symptoms of trouble)
1. Starting motor operates, but engine fails to start or starts only with difficulty.
 2. Engine starts but then dies.
 3. Rough idling
(Engine speed, exhaust gas).
 4. Poor throttle response, flat spot during acceleration.
 5. Misfiring
(ignition, fuel induction).
 6. Maximum engine power/top speed reached.
 7. Fuel consumption too high.
 8. Engine diesels.
 9. Engine pings/knocks.
 10. Engine becomes too hot.
 11. Fault lamp.

| Cause (component fault) | | | | | | | | | | |
|-------------------------|---|---|---|---|---|---|--|---|--|---|
| | * | | | | | * | | | | Test adjustment, throttle valve stage I |
| | * | * | * | * | * | | | | | Incorrect type of nozzle |
| | | * | | * | | | | | | Vacuum unit, stage II |
| | * | * | | * | | | | | | Test adjustment, throttle-valve stage II |
| | | * | | * | * | | | | | Test adjustment, accelerator actuation |
| | * | * | | | | | | | | Throttle valve worn out |
| | | | | | | | | * | | Test TD signal |
| | | | | * | * | | | | | Test enrichment tube |
| | * | * | | | | | | | | Test bypass heating |
| * | | | | * | * | | | | | Float-chamber change-over valve defective |
| | * | * | | | | | | | | Test activated carbon filter (Visual exam.) |
| | * | | | | | | | | | Venting filter, throttle-valve actuator |

TROUBLE-SHOOTING:
USING THE SELF-DIAGNOSIS:

A control unit is installed in this vehicle, which possesses a self-diagnosis facility. Therefore, always begin trouble-shooting with self-diagnosis. Self-diagnosis is divided into two parts:

1. Reading out the fault memory (self-diagnosis)
2. Final-controlling-element diagnosis.

After stimulation of the self-diagnosis at the intake-manifold-heating relay, all the electronic control units intalled in the vehicle, which are equipped with self-diagnosis, are induced to output their diagnosis. In the self-diagnosis test table starting on coordinates (13) , the indicated faults of the Ecotronic are broken down. The self-diagnosis test table contains fault indication, components tested, test clips at control-unit plugs, cause of trouble, test instructions and set values.

Only if there is no fault stored in the fault memory, but there is a customer complaint, must trouble-shooting be performed in accordance with the trouble-shooting charts starting at coordinate (06) . Only the components which cannot be tested via the self-diagnosis facility are listed in the trouble-shooting charts.

SELF-DIAGNOSIS

Fault lamp (engine indicator lamp)

Fault lamp in instrument panel lights up when the ignition is switched on.

Start engine:

1. Fault lamp goes out shortly after the engine starts to run.
2. Fault lamp does not go out or fault lamp lights up constantly or intermittently during driving: No engine-speed signal present, or contacts at intake-manifold-heating relay bridged.

Activating the self-diagnosis:

Leave the engine running at idle (if necessary, take for test drive beforehand) or operate starting motor for approx. 6 seconds (do not switch off ignition).

With a fuse (smaller than 25 A) at the intake-manifold-heating relay (center illustration), apply excitation lead to control unit (term. 6) for longer than 4 seconds to ground.

Output of the self-diagnosis begins with a start signal (lower illustration, a) (fault lamp lights up approx. 2,5 s.)

Activating the final-controlling-element diagnosis:

Switch off the ignition (min. 20 s.). Using a fuse, apply excitation lead at intake-manifold-heating relay to ground. Switch on ignition.

After longer than 4 seconds, disconnect the fuse.

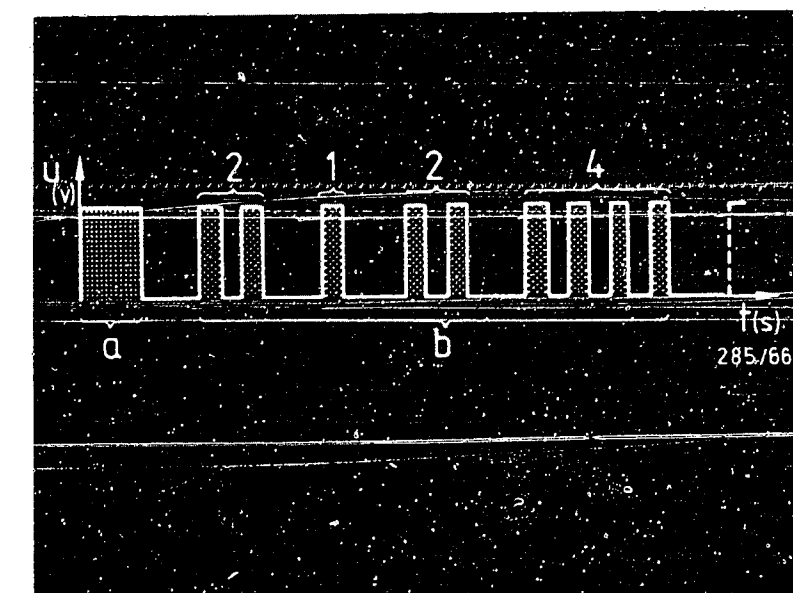
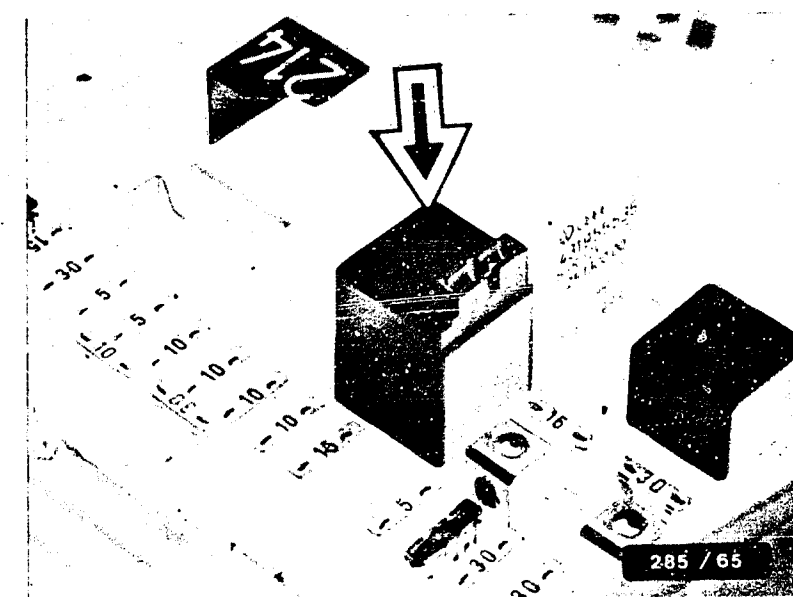
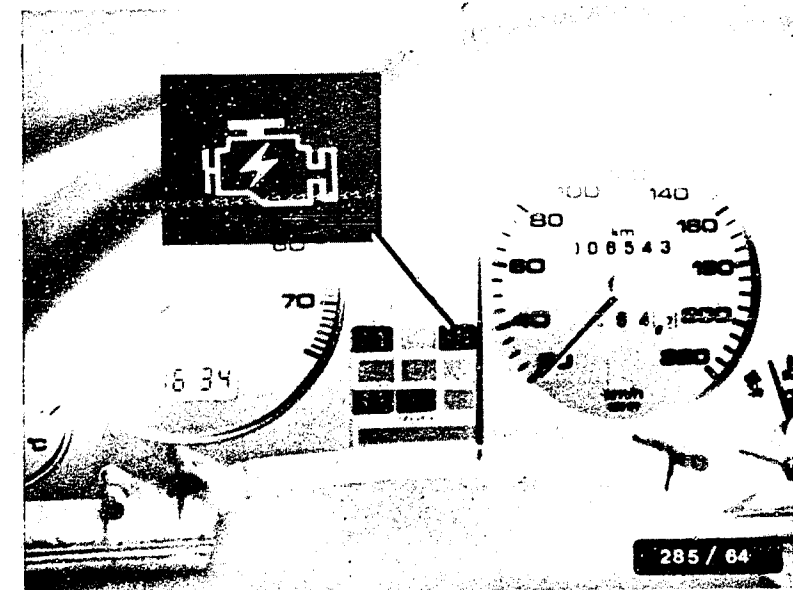
On output of the final-controlling element diagnosis

(flashing code 4323, 4324, 4342 and 4343),

the corresponding final controlling elements are triggered simultaneously with output of the flashing code and can be tested by listening/feeling (flashing code indicates only which component is triggered).

Continuing diagnosis:

After one fault has been read out, the next fault is output/ the next final controlling element triggered through renewed short circuit to ground for longer than 4 seconds.



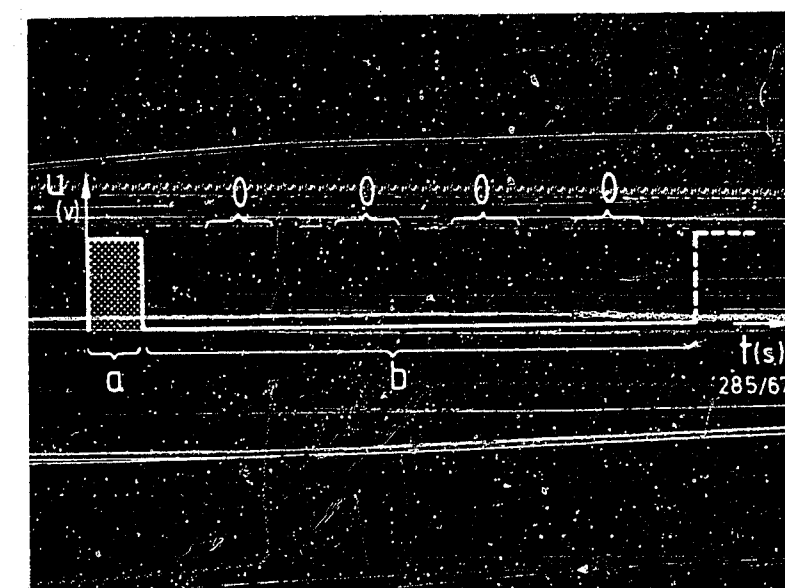
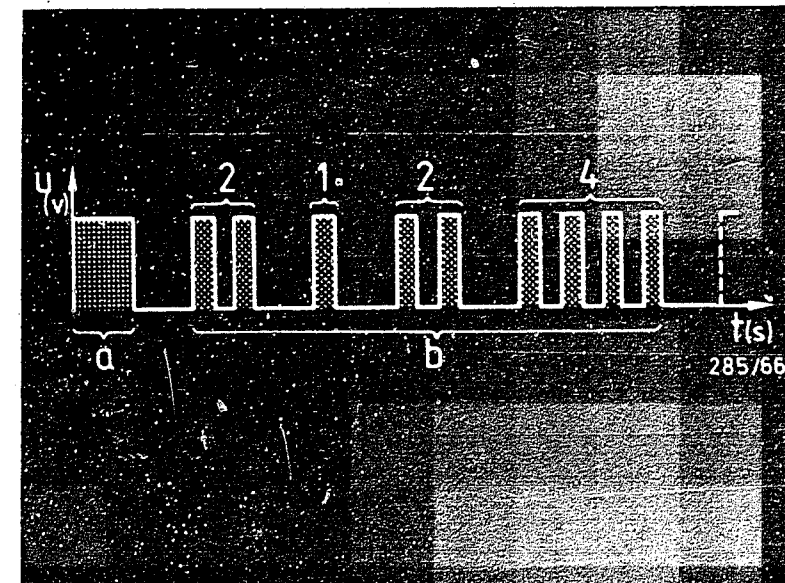
Evaluating the flashing code (lower illustration, b):

The flashing code for each fault consists of four flashing-pulse blocks. Each block represents a number and comprises 1 up to 4 pulses. One pulse corresponds to the number 1, four pulses correspond to the number 4. The fault lamp lights up briefly with every pulse.

There is a longer pause between the blocks than there is between the individual pulses. After a fault code has been output, the new fault code is initiated by a renewed short circuit to ground of longer than 4 s.. If no fault is stored in the control unit, the flashing code 4444 is output.

If a fault is stored in the control unit, the first fault (upper illustration, b) is output after the start signal. If a further fault is stored, its flashing code is output by a renewed short circuit ground.

The sequence must be continued until the flashing code 0000 (see lower illustration) indicates the end of self-diagnosis. The fault memory is cleared by switching off the ignition and approx. 15 seconds later, the main relay drops out.



SELF-DIAGNOSIS TEST TABLE

| Fault indic. Flash code | Testing of component/function | Test instructions/Test conditions | Termin- als | Set values |
|----------------------------|---|---|---------------------------------|--|
| 4444 | Control unit | Control unit indicates that there is no fault stored in the fault memory. | — | — |
| 1111 | Control unit defective | | — | — |
| 2224 | Maximum engine speed exceeded | Maximum engine speed 7000 min^{-1} was exceeded when driving. (Test engine-speed limitation on vehicle-performance tester). | 25 2 12 12 | 6950 min^{-1} -0,6...-2,8 A |
| 2124 | Potentiometer in throttle-valve actuator (short circuit to ground/open circuit) | Resistance throttle-valve potentiometer and throttle-valve actuator parallel: Wiper resistance, potentiometer in throttle-valve actuator: (while testing, actuate evacuating valve in throttle-valve actuator and pull back throttle-valve actuator using hand vacuum pump). Resistance value drops continuously. | 18 13 17 13 17 13 | 0,7...1,3 k Ω max: 1,4...2,4 k Ω min: less than 400 Ω |
| 2212 | Throttle-valve potentiometer (short circuit to ground/open circuit) | Resistance throttle-valve potentiometer and throttle-valve actuator parallel: Wiper resistance, throttle-valve potentiometer: Run engine at idle. Seal off ventilating side of throttle-valve actuator. Switch off engine. Switch on ignition. Slowly push accelerator pedal from idle position to full-load position: Resistance value is altered continuously between min. and max.. | 18 13 11 13 11 13 | 0,7...1,3 k Ω max: 1,4...2,4 k Ω min: less than 270 Ω |

SELF-DIAGNOSIS TEST TABLE (continued)

| Fault indic. Flash code | Testing of components/function | Test instructions/Test conditions | Termin- als | Set values |
|----------------------------|---|---|----------------|--|
| 2312 | Coolant-temperature sensor (short circuit to ground/open circuit) | Resistance of temperature sensor: at 20°C at 80°C | 21 13 21 13 | 2,0...3,0 k Ω 280...360 Ω |
| 2341 | Lambda closed-loop control at control limit | Test lambda closed-loop control and re-adjust control range: initiate indication of lambda control range at intake-manifold-heating relay. | 6 | Fault lamp in instrument panel flashes with 1,5 Hz |
| 2342 | Lambda sensor | Test lead from control unit term. 8 to plug connection of lambda sensor for short circuit and open circuit (plug connection of lambda sensor disconnected). | 8 2 8 | greater than 1 M Ω approx. 0 Ω |
| 2412 | Intake-manifold temperature sensor (short circuit to ground/open circuit) | Resistance of temperature sensor: at 20°C at 80°C | 5 13 5 13 | 2,0...3,0 k Ω 280...360 Ω |
| 0000 | Diagnosis output complete | Control unit indicates that the diagnosis output is complete. Fault lamp flashes at 2,5 s. intervals (start signal). | — | — |

SELF-DIAGNOSIS TEST TABLE (continued)

Final-controlling-element diagnosis (component is activated by control unit during flashing-code output).

| Flash code | Testing of components/function | Test instructions/Test conditions | Terminals | Set values |
|------------|--|--|--------------------|---|
| 4432 | Choke-valve actuator | Choke-valve actuator is activated during diagnosis output. Insulation resistance of choke-valve actuator: Winding resistance of choke-valve actuator: | 10 12 10 12 | greater than 1M Ω less than 10 Ω |
| 4343 | Activated-carbon-filter bleeder valve | Final-controlling-element diagnosis: bleeder valve is actuated during flashing-code output. Insulation resistance Winding resistance | 15 2 15 23 | greater than 1 M Ω less than 50 Ω |
| 4342 | Relay for intake pre-heating | Final-controlling-element diagnosis: relay is actuated during flashing-code output. Insulation resistance Winding resistance | 14 2 14 23 | greater than 1 M Ω less than 50 Ω |
| 4323 | Ventilating valve in throttle-valve actuator | Final-controlling-element diagnosis: ventilating valve is actuated during flashing-code output. Insulation resistance, ventilating valve: Winding resistance, ventilating valve: | 9 2 9 23 | greater than 1M Ω 20...80 Ω |
| 4324 | Evacuating valve in throttle-valve actuator | Final-controlling-element diagnosis: evacuating valve is actuated during flashing-code output. Insulation resistance, evacuating valve: Winding resistance, evacuating valve: | 3 2 3 23 | greater than 1M Ω 20...80 Ω |
| 0000 | Diagnosis output complete | Control unit indicates that the diagnosis output is complete. Fault lamp flashes at 2,5 s. interval (start signal). | — | — |

TEST SPECIFICATIONS:

Idle speed: 900 \pm 75 min⁻¹
Note: the idle speed is controlled and cannot be adjusted.

Engine-speed limitation 7000 \pm 50 min⁻¹

Exhaust-gas adjustment:
Test CO value at sampling pipe before catalytic converter: %CO by vol. 0,2...1,0
To do this, hose for engine ventilation and lead to lambda sensor are disconnected.

Fuel pressure: 0,1...0,3 bar
Minimum fuel delivery
(at 2000 min⁻¹) 1 l/min

Float weight: 7,7 \pm 0,3 g
Float height: 27,5 \pm 1,0 mm
(Float level cannot be adjusted)

Throttle-valve potentiometer
Total resistance: 1.4...2.6 k Ω
Wiper resistance in correcting range: min. less than 270 Ω
max. 1,4...2,4 k Ω

Choke-valve actuator.
Winding resistance: 0,9...1,7 Ω

Basic setting, throttle valve
Stage I (with feeler gauge) 3,15 mm
Stage II $a = 0,03 \pm 0,02$ mm

Release and forced return
Stage II: Y = 1,0 \pm 0,3 mm
Z = 0,4 \pm 0,2 mm

Float-chamber change-over valve
Winding resistance less than 50 Ω

Activated-carbon-filter bleeder valve
Winding resistance: 30...60 Ω

TEST SPECIFICATIONS (continued):

Throttle-valve actuator
Evacuating valve (term. 1 /term. 2): 20...70 Ω
Ventilating valve (term. 6/term. 7): 20...70 Ω
Total resistance, potentiometer (term. 3/term. 4): 1,4...2,6 k Ω
Wiper resistance in correcting range (term. 5/term.3): min. less than 400 Ω
max. 1,4...2,4 k Ω

Temperature sensor (NTC):
Internal resistance at 20°C: 2,0...3,0 k Ω
at 80°C: 280...360 Ω

Heating element, intake-manifold heating:
Internal resistance at 20°C: approx. 0,25...0,5 Ω

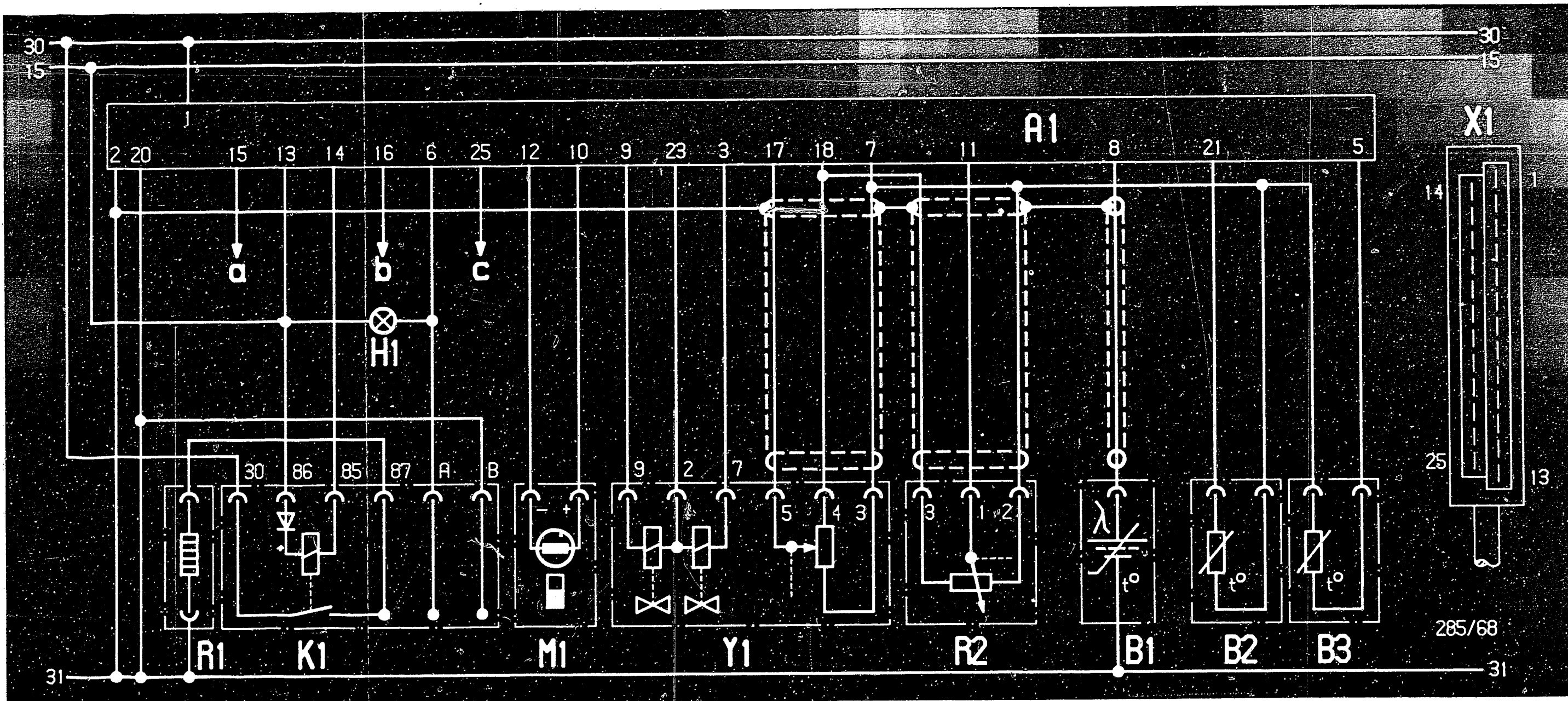
Heating element, part-load channel:
Internal resistance at 20°C: approx. 1,5...2,5 Ω

| Type of nozzle: | Stage 1 | Stage 2 |
|--|---------|--------------|
| Main nozzle | x 105 | x 110 |
| Idle fuel nozzle | x 45 | |
| Acceleration fuel nozzle | | 90 |
| Air correction nozzle (with mixing tube) | x 110 | x 105 |
| Acceleration air nozzle | | x 130 |
| Full-load enrichment | | 100 \pm 10 |

Tube for full-load enrichment
Height above pre-atomizer 13,5 \pm 1,0 mm

Tightening torques
Securing of carburetor upper section 5 Nm
Flange mounting 13 Nm

See equipment and Autodata microcards for setting values for valve clearance and other motor-related data.



ELECTRICAL TERMINAL DIAGRAM OF ECOTRONIC

A1 = Control unit, Ecotronic

X1 = Plug assignment

R1 = Heat. elem., intake-manif. heating

K1 = Relay, intake-manifold heating
(contacts A,B for stimulation
of self-diagnosis)

M1 = Choke-valve actuator

Y1 = Throttle-valve
actuator

R2 = Potentiometer,
main throttle valve

B1 = Lambda sensor

B2 = Temperature sensor, coolant

B3 = Temperature sensor, intake manifold

H1 = Diagnostic lamp

a = to bleeder valve,
activated carb. filt.

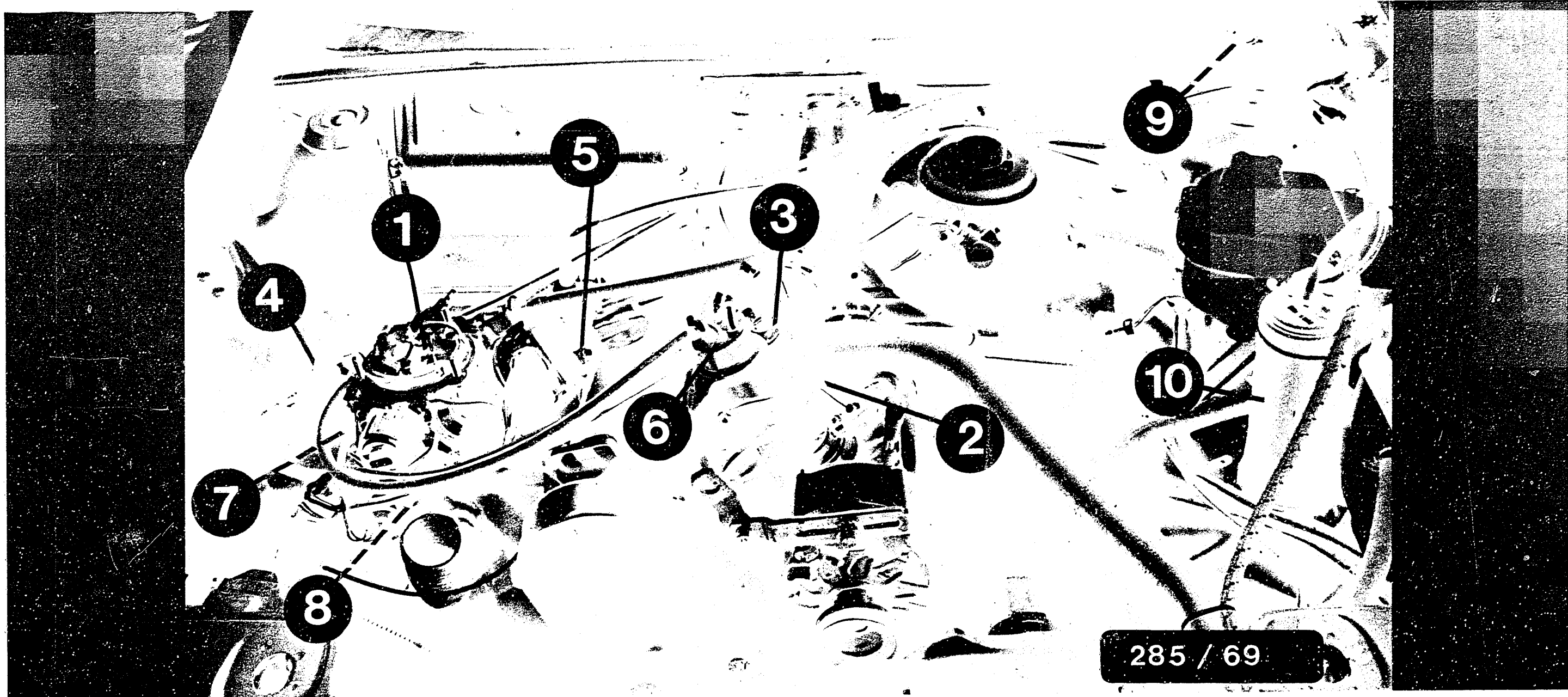
b = Transmission recog.

c = TD signal

M21

M22

285/68

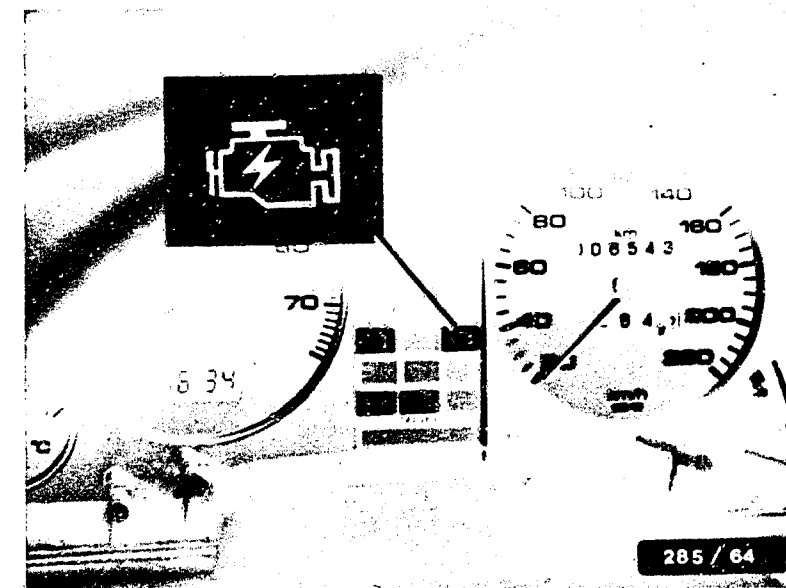


INSTALLATION POSITION OF COMPONENTS

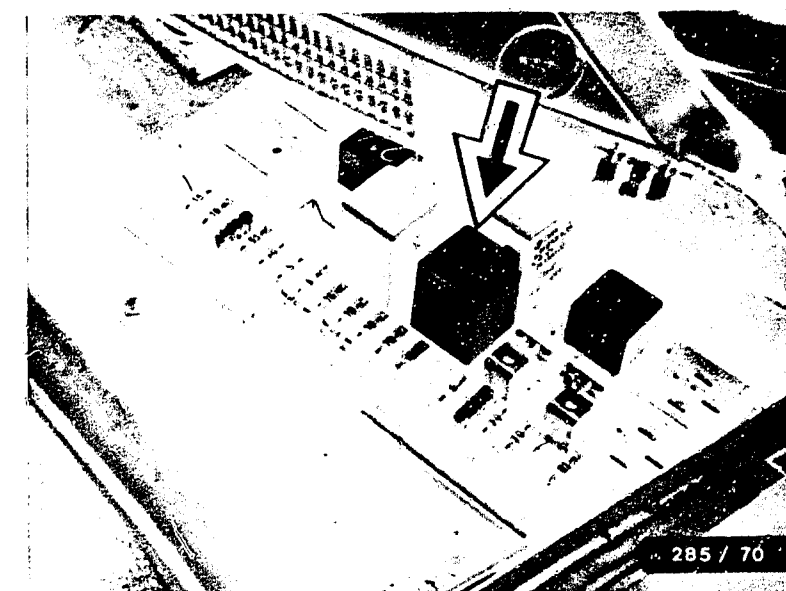
- | | | |
|---------------------------------|--|--------------------------------------|
| 1 = Carburetor | 4 = Activated carbon filter, control valve | 7 = Sampling pipe for CO measurement |
| 2 = Ignition distributor | 5 = Temperature sensor, intake manifold | 8 = Lambda sensor |
| 3 = Temperature sensor, coolant | 6 = Vapor-bubble separator | 9 = Central electrics |
| | | 10 = Activated carbon filter |

INSTALLATION POSITION OF COMPONENTS (continued)

The fault lamp is located in the instrument panel (upper illustration).



The relay of the intake manifold heating is located in the central electrics (center illustration, arrow).



The control unit is installed in the right-hand footwell beneath the cover (already removed in the lower illustration).

